Electronics & Technology Today

Canada's Magazine for High-Tech Discovery

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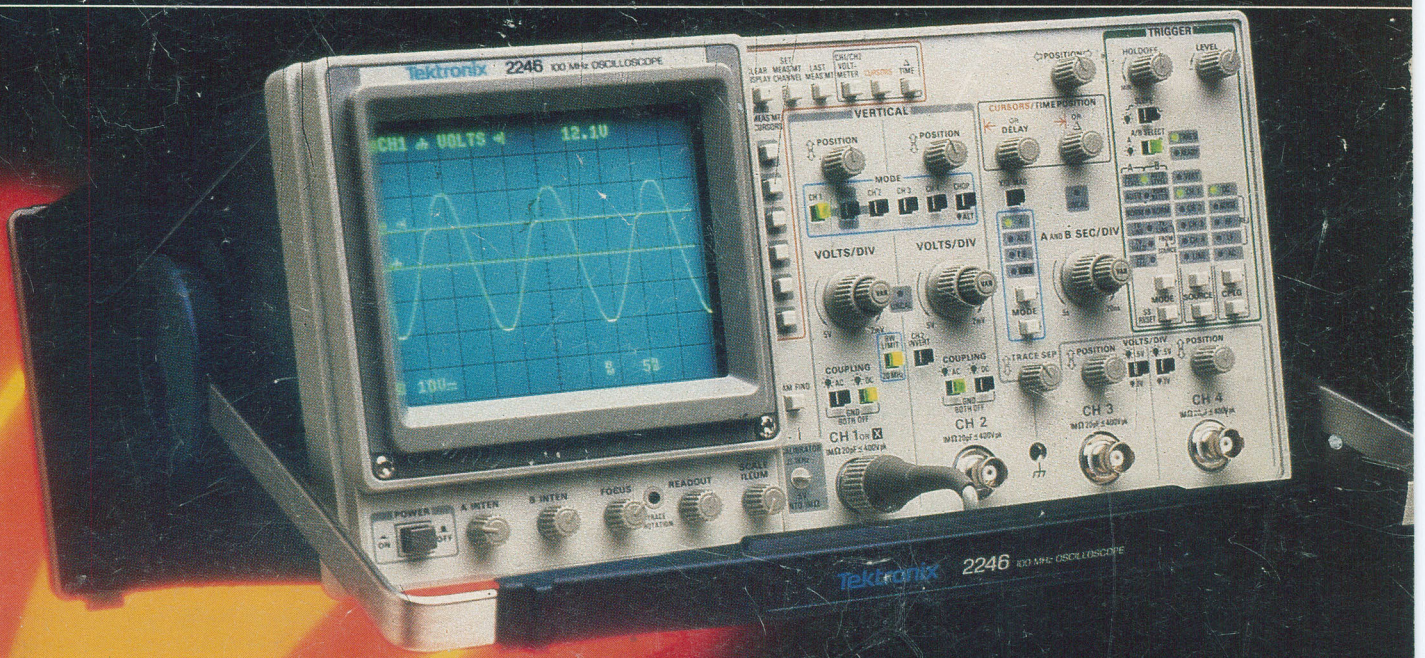

DC CIRCUIT BASICS
THE CURRENT RING
USING LIQUID CRYSTALS
LIGHT SENTINEL

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Full Scale Scanner
See Page6

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EXCELTRONIX INTRODUCES 80486 FOR UNDER $4000

THE BES

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BEST COMPACT 386SX

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New SX motherboard has all peripherals listed above on board leaving you with 6 expansion slots.

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(16 + 20 MHz 386 System)

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New 386 motherboard has all peripherals listed above on board leaving you with 6 expansion slots.
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(10 MHz, 3-slot XT Compatible)

Based on the 16-Bit 10MHz 8086 microprocessor, Phoenix BIOS, Available with one 360K 5.25" Floppy or up to two 720K 3.5" Floppy Diskette Drive, socketed for 8087 math co-processor, 640K RAM, 3 Full-Length XT Expansion Slots, Two Serial Ports, One Parallel Port, Real Time Clock, Also features On-Board Hercules Compatible Display Adapter, Floppy Controller and SCSI Hard Drive controller, key lock for system and case, 101 Enhanced Keyboard.

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COMPACT 286-16

(16 MHz, 8-slot AT Compatible)

Based on the Intel 80286 microprocessor, Phoenix BIOS, One 1.2MB Floppy Diskette Drive (Optional 360K 5.25" Floppy Drive or 720K 3.5" Floppy Drive or 1.44MB 3.5" Floppy Drive), socketed for 80287 math co-processor, 640K RAM (Optionally expandable to 1 MB onboard or higher using 16-Bit memory expansion cards), 8 Expansion Slots, Two Serial Ports, One Parallel Port, Real Time Clock, Floppy Controller and Hard Drive Controller, 101 Enhanced Keyboard.

Compact 286-16 runs at
16 MHz with 1 Meg Memory $ 1195
with 40 MHz Hard Drive $ 1695

BEST
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Exceltronix introduces the BEST ELITE 33 Mhz 80386-0 Wait State with Cache Memory at an incredible introductory price offer.

Basic ELITE 386-33/0 System includes: Intel 80386 32 Bit Microprocessor, 32K cache memory, 0 wait state, 1 1.2 Meg Floppy Disk Drive (optional 360K 5 1/4" Floppy Drive, or 1.44 MB 3.5" Floppy Drive), Socketed for 80387 math co-processor, 8 expansion slots, 2 serial ports, 1 parallel port, real time clock, floppy controller, hard drive controller, heavy duty power supply, 101 enhanced keyboard. Available with the following memory configurations: 1 Mb, 2 Mb, 4 Mb, 8 Mb, 16 Mb of 32 Bit on board memory. Attractively packaged in a tower case with lots of room for expansion. Includes 1Mb of Ram.

Exceltronix introduces 80486 for under $4000

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Electronics &
Technology Today
Canada's Magazine for High-Tech Discovery
Volume 14 , Number 3 March , 1990

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We do not supply printed circuits or kits, and we do not keep track of availability. However, PCBs for projects are available from the following mail order sources:

B-C-D Electronics, PO Box 6326, Stn. F., Hamilton, Ontario L9C 6L9.

K.S.K. Associates, PO Box 266, Milton, Ontario L9T 4N9.

Spectrum Electronics, 14 Knightswood Crescent, Brantford, Ontario N3R 7E6.

GeoDyssey Electronic Development Inc., 8744 Greenall Avenue, Burnaby, B.C., Canada V5J 3M6.

Affordable Scanner
The scanner shown in our second cover photo is the Planscan from Planon Systems, ideal for any CAD or desktop publishing requirement. You can scan a drawing 36" wide and any length at up to 400 dots per inch in just a few minutes. Once in your computer, you can use various software programs to set the lightness, the file format and more. Viewbase, a database for images, lets you search, view, zoom and print your document. The Cadoverlay program lets you convert your scanned raster image into hybrid raster/vector drawing files for AutoCAD™ or Versacad™. For more information, contact Planon Systems Inc., 2780 Skymark Avenue, Units 5-7, Mississauga, Ontario L4W 5A7, (416) 624-6222, Fax 624-6535.

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Oops, again...
After all our promises, too. It seems that the desktop publishing computer truncated the program listing in January's *A Microsoft Mouse for C.* Well, that's our story and we're sticking to it. Those of you who tried this program will have searched in vain for the listing "MOUSE.H". Here is the missing text:

```
/*Header File For Microsoft Mouse*/

/*Copyright (C) Doug Bedrosian 1989*/

/*mouse interrupt number     */
#define MOUSE    0x33
/*resets the mouse, and returns the
 following:
 m_pram_1 = 0 if mouse not found
 m_pram_1 = -1 if mouse installed
 m_pram_2 = # of mouse buttons  */
#define RESET    0
/*displays the cursor on the screen
 there is no return information  */
#define CURSOR_ON  1
/*removes the cursor from the
 screen, no information is returned*/
#define CURSOR_OFF  2
/*used for returning information
 about the mouse
 m_pram_2 = button status
 m_pram_3 = horizontal position
 m_pram_4 = vertical position  */
#define GET_INFO  3
/*used for placing the cursor at a
 certain location, the following
```

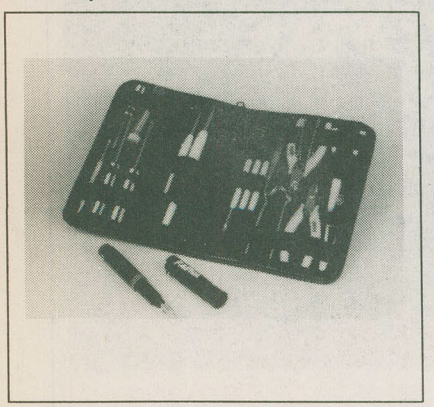
must be specified:
m_pram_3 = new horizontal position
m_pram_4 = new vertical position */

#define PLACE_CURSOR 4
/*used for setting the horizontal cursor movement, the following must be specified:
m_pram_3 = min. hor. position
m_pram_4 = max. hor. position */
#define SET_HORIZONTAL 7
/*used for setting the vertical cursor movement, the following must be specified:
m_pram_3 = min. ver. position
m_pram_4 = max. ver. position */
#define SET_VERTICAL 8
/*used for setting the sensitivity of the mouse, the following must be specified:
m_pram_3 = horizontal sensitivity
m_pram_4 = vertical sensitivity */
#define SET_MOTION 15

Our apologies to those who were inconvenienced by this omission.

Servicing Tools

Brunelle Instruments announces the Fastool line of servicing tools. The main item of interest is the butane energy source soldering iron and different tips that can be used for soldering and melting plastics, heating small parts, etc. It needs no electricity, and so is ideal for field work.

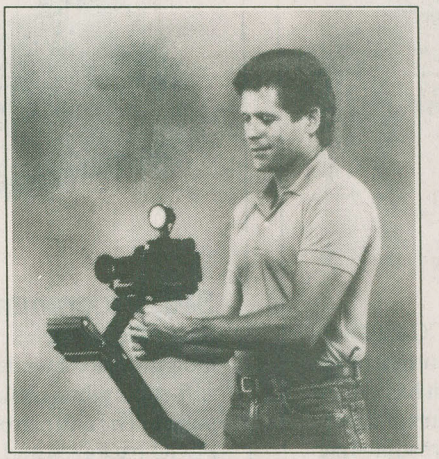


A brochure explains the four models available, plus descriptions of tool kits consisting of cutters, heat sinks, screwdrivers, desoldering tools, tweezers, test lamps and more. Contact Brunelle Instruments, 73-6th Range South, St-Elie-d'Orford, Quebec J0B 2S0, (819) 563-9096, FAx 569-1408.

Circle No. 4 on Reader Service Card

Low Cost Steadicam

The professional Steadicam™ has long been used in movies and TV to get steady, shake-free pictures with handheld TV cameras. Now Cinema Products introduces the Steadicam Jr™, a grip that lets you stabilize your video camera economically. Listing at $579 US, the Jr will allow



you to climb stairs, move around outside, etc. Using inertia rather than expensive gyros, it has a 3 1/2" B&W monitor and a small light that fits on the top of your camera. The entire unit is powered by four C cells. You can use the video camera of your choice, as long as it weighs less than 3.5 pounds; the total weight of the camera and unit will be between 4.1 and 6.3 pounds, including batteries and counterweights. The whole unit is said to be very easy to handle, although it won't feel weightless. The display monitor, a backlit LCD, will work even in bright sunlight.

Since the Steadicam Jr. is a new product, you may have to search around a bit to locate one, or you can contact the manufacturer, Cinema Products, 3211 So. La Cienega Blvd, Los Angeles, CA 90016, (213) 836-7991, Fax 836-9512.

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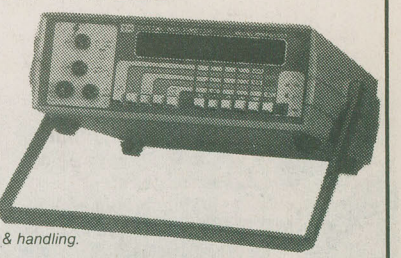

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HC-5050E

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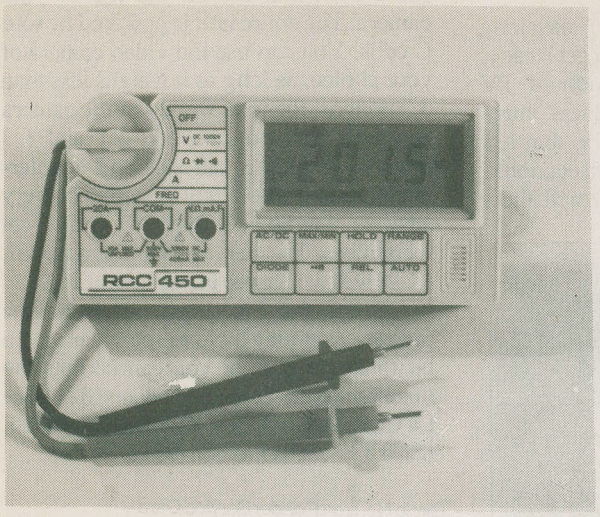

Bargraph DMM

RCC Electronics have announced the model RCC 450 Digital Bargraph Multimeter with a fuse protected current range and PTC protection on the ohms scale. The unit has a 3 3/4 digit LCD display with a resolution of 4000 counts and a 41-segment bargraph. The measurement rate is 10 readings per second. RCC Electronics Ltd., 310 Judson St., Unit 19, Toronto, Ontario M8Z 5T6, (416) 252- 5094, Fax 252-3031.

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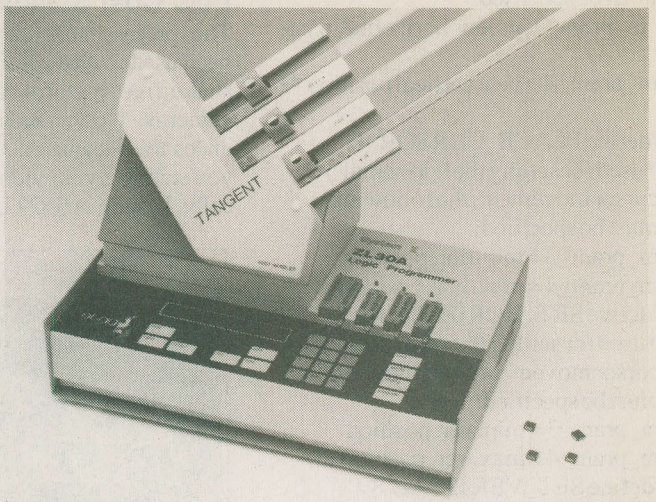

SMD Programmer

Stag Microsystems has announced the Tangent surface-mount-device handler/programmer. The devices remain in anti-static tubes, avoiding damage, contamination or ESD exposure. The unit can be configured for 20 through 52 pin J lead PLCC packages and will interface to other manufacturer's programmers. Allan Crawford Associates, 5835 Coopers Avenue, Mississauga, Ontario L4Z 1Y2, (416) 568-2020, Fax 890-1959.

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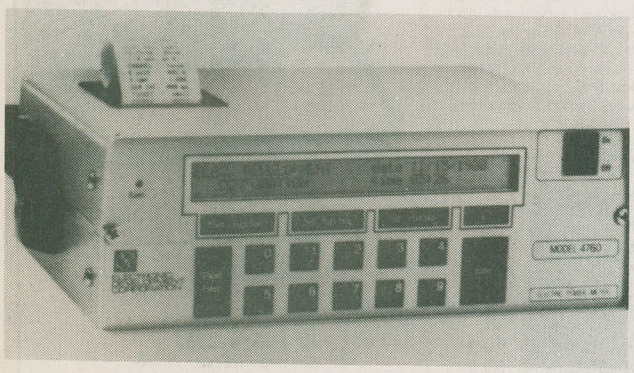

Recording Analyzer

The Electric Development Corporation has announced the Model 4760 portable power analyzer. The microprocessor-based unit provides analysis of voltage, current, power factor, watts and more. Recording intervals and the printer are programmable and include operator prompts and non-volatile data storage. Omnitronix, 2410 Dunwin Dr., Unit 4, Mississauga, Ontario L5L 1J9, (416) 828-6221, Fax 828-6408.

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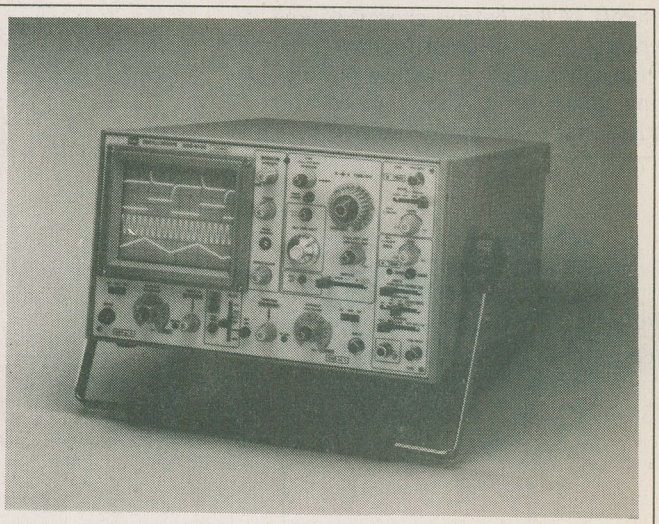

100MHz Scope

Goodwill Instruments announce their new 100MHz, four-channel/trace oscilloscope, the model GOS6100. Features include sensitivity to 5mV/div., 6" CRT, autofocusing, 3.5ns risetime, triggered hold-off and more. Duncan Instruments, 121 Milvan Drive, Toronto M9L 1Z8, (416) 742-4448.

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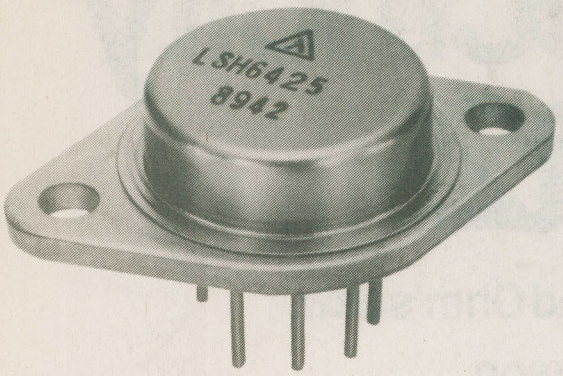
For Your Information



Microconverters

Lambda Semiconductors announces the LSH-6400 DC-DC microconverter in military TO-3 and plastic TO-220 packages. The regulator chip, output diode and compensation network are all included in a single package. The voltage range is 12 to 40VDC input with an output range of 5 to 31VDC. Write Lambda Semiconductors, 4125 Cousens St., St Laurent Quebec H4S 1V6.

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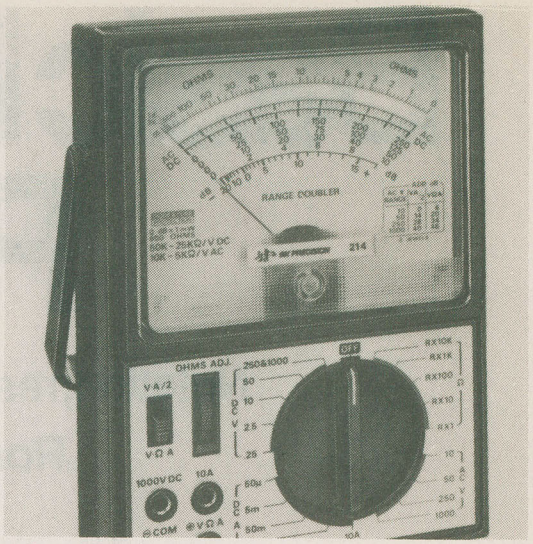

Analog Meter

If you need a standard analog multimeter with very high input resistance, B&K offers the Model 214, with a sensitivity of 50,000 ohms per volt. It's diode- and fuse- protected and has 37 ranges. Atlas Electronics, 50 Wingold Ave., Toronto, Ontario M6B 1P7, (416) 789-7761, Fax 789-3053.

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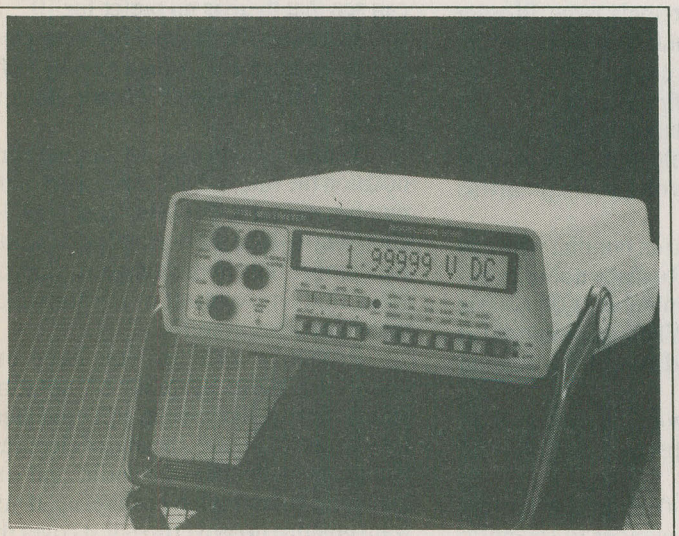

GPIB-DMM

The Goodwill Instruments Digital Multimeter GDM8055 features 6 1/2 digits, manual or autoranging selection, a data logger, relative measurement mode and more. In addition, the optional GPIB (IEEE-488) allows interfacing with computers or other test equipment. Duncan Instruments, 121 Milvan Drive, Toronto, Ontario M9L 1Z8, (416) 742-4448.

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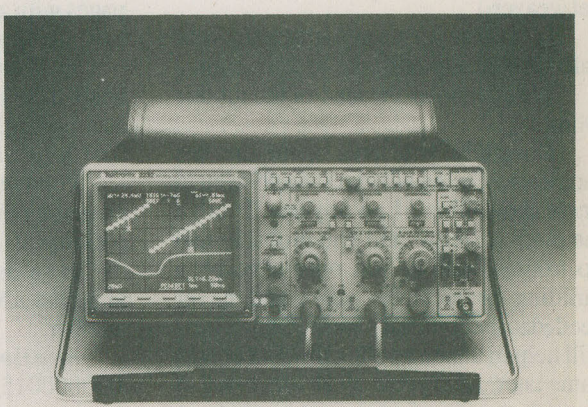

A/D Scope

The Tektronix 2232 is a 100 MS/s analog/digital storage scope which is optimized for capturing all elements of signal detail. It provides peak detect capabilities with glitch capture as low as 10ns, as well as 8-bit vertical resolution and a 4K record length. Tektronix Canada Inc, PO Box 6500, Barrie, Ontario L4M 4V3, (705) 737-2700, Fax 737-5588.

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FEATURE

Basic Electricity Part2

Notation, resistors and Ohm's Law.

Ron C. Johnson

Whether you are starting out in electronics, golf, playing the piano, or basket weaving the same principles apply: Get the basics down cold and you'll be off to a good start. From there you can work your way into the more complex stuff with a minimum of problems. (That's what I did, and today I'm an incredible basket weaver.)

So fasten your seat belts, grip your calculator firmly, and take a deep breath...

We now enter the land of the mobile Ohm.

No doubt you have spent the last month wondering why you would want to know about Ohm's Law anyway. Though the math is simple and you probably had no trouble with it, you may have been building projects for years and never needed to use it. Just the same, Ohm's Law will help in understanding the concepts to come later. Also you may be interested in designing some of your own projects, in which case this will all be useful. Another electrical law we will talk about this month is Kirchoff's Voltage Law. Again, though basic and a bit math oriented, this is useful in understanding how circuits work.

I said last month we would get into some circuits and some of the components used in them. First, though, we should establish a common numbering system and standard coding for resistors, capacitors and other components so that we are talking the same language later on.

Counting Like Scientists And Engineers

In electronics, as we said last month, mathematics plays an important role in determining the quantities of various parameters. We talked about voltage, current, resistance and power to start with. These are all determined with math and can have values which range from extremely small to extremely large. In order to express these numbers without filling pages with zeros we use a system of numbering called *scientific notation*.

In scientific notation we take a number like 2,540,000 volts, which is the same as 2.54 X 1,000,000 volts, and express it as 2.54×10^6 volts.

For those of you not familiar with this notation, our goal is to make a shorter expression of the same number. 1,000,000 is the same as 10^6. When we multiply it times the 2.54 we end up with the original number.

Similarly, we can express .00000001579 Amps as 1.579×10^{-8} Amps.

The easy rule to remember is that when we convert a number to scientific notation we count the number of decimal places we will move the decimal point and use that number as the exponent of ten. If we move the decimal to the left (in a large number), the exponent is positive. If we move the decimal to the right (in a small number), the exponent is negative.

That is scientific notation.

In *engineering notation* we shorten up the number even further by using prefixes before the units we are expressing. The common prefixes which correspond to exponents of ten are given in Figure 1. Referring back to our examples, for the first one we can take the prefix "mega" from the table (as it corresponds to 10^6) and we get 2.54 mega volts, or 2.54MV.

In the second example we have an exponent of ten to the -8. From the table we can see that there is no prefix for 10^{-8}, so we must move the decimal right one place so that we have 10^{-9}, which has the prefix "nano". This gives us 15.79 nano amps, or 15.79nA.

When converting to engineering notation the rule is that the first part of the number should be between 0 and 999. By choosing to place the decimal point so that the number falls in that range you can always find an exponent of ten for which there is a common prefix.

Probably most of you have encountered these systems of notation before, but maybe you haven't used them for a while. In Figure 2 a table of electrical quantities with their scientific and engineering notations has been set up. If you want practice in converting, just cover the middle and right columns with a piece of paper and do the conversions yourself. Then uncover the answers and see how you did. (Betcha nobody does them!)

Okay, now I have you all convinced that the rest of this is going to be pure math. Right? No. We'll try to keep it to a minimum. What we really need the engineering notation for right now is to understand the resistor color code.

Fig. 1: Prefixes for Engineering Notation

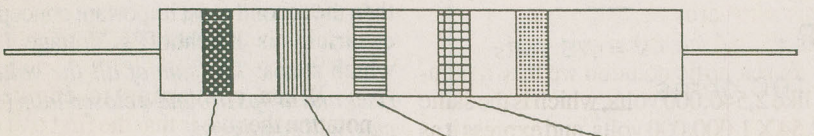
Prefix	Symbol	Multiplier	Exponent
Giga	G	1,000,000,000	10^{9}
Mega	M	1,000,000	10^{6}
Kilo	K	1,000	10^{3}
milli	m	.001	10^{-3}
micro	u	.000001	10^{-6}
nano	n	.000000001	10^{-9}
pico	p	.000000000001	10^{-12}

Fig. 2 Table of Electrical Quantities with Scientific Notation and Engineering Units

Electrical Quantity	Scientific Notation	Engineering Units
254,200,000 volts	2.542×10^{8}	254 Megavolts
.00276 Amps	2.76×10^{-3}	2.76 milliamps
8990 ohms	8.99×10^{3}	8.99 kilo ohms
750,000 watts	7.50×10^{5}	750 kilowatts
.0000047 Siemens	4.77×10^{-6}	4.77 microSiemens
.000000000012 Farads	1.2×10^{-11}	12 picoFarads

Violet And The Bad Boys

Resistors (and, less often, capacitors) use a code consisting of bands (or sometimes dots for capacitors) of color on the component to indicate the value of the component. We learned last month that resistors are the components which have the property of resistance built into them. Resistance is that property which opposes the flow of current in a circuit and is measured in ohms. The colored bands on a resistor give us the value of resistance and the tolerance of the resistor. The tolerance is an indication, in percent, of how precisely the resistor was manufactured. If it has a ten percent tolerance the actual value of the resistor will be within plus or minus ten percent of the value given by the colored bands on it.



Colour	Band #1 Digit 1	Band #2 Digit 2	Band #3 Multiplier	Band #4 Tolerance
Black	0	0	10^{0}	-
Brown	1	1	10^{1}	1
Red	2	2	10^{2}	2
Orange	3	3	10^{3}	3
Yellow	4	4	10^{4}	4
Green	5	5	10^{5}	-
Blue	6	6	10^{6}	-
Violet	7	7	10^{7}	-
Grey	8	8	10^{8}	-
White	9	9	10^{9}	-
Gold	-	-	10^{-1}	5
Silver	-	-	10^{-2}	10

Fig. 3. The resistor color code.

Figure 3 shows a resistor, its bands, and the corresponding values of the color code.

The mnemonic used to remember the color code, (or at least the one that is printable) is:

Bad Boys Race Our Young Girls But Violet Generally Wins.

(Good Stuff!)

Figure 3 shows how the first letter of each word of the mnemonic represents a color and its value. Note that the first two bands give the first two digits, the third gives a multiplier (which corresponds to an exponent of ten), and the last band is the tolerance. If there is no fourth band the tolerance is assumed to be 20%.

Sometimes there are five bands on resistors. These are usually precision resistors and the extra band (the third one) is an extra digit to more precisely indicate the value of the resistor.

For all you keeners who want to practise determining values from the color code, Figure 4 gives several examples with their resistances. To practise, just cover the right hand column while you figure out the answers and then check to see how you did.

Onward And Upward

Let's get on with the good stuff then.

One of the last things we did last month was set up a simple circuit with a battery, wire, and a lamp. We calculated how much current was flowing, whether it was within the specs of the lamp, and how much power was being dissipated. That circuit was called a *series* circuit because everything was connected end to end. All the current in the circuit flowed through all the components. (Note that whenever we talk about current we say that it flows "through" a component or conductor.)

If all the current flows through all of the components, what would happen if the wire became disconnected from the battery or if the filament of the lamp burnt out? Obviously there would no longer be a path for current to flow and all of the current would stop. (Remember we must have a complete circuit or circle for current to flow in.) This is called an *open cir-*

Colour code	Equivalent Resistance
Red, Red, Orange, Gold	22 Kohm, 5 %
Green, Blue, Gold, Gold	5.6 ohms, 5 %
Grey, Red, Red, Silver	8.2 Kohm, 10 %
Brown, Black, Brown	100 ohms, 20%
Orange, Orange, Blue, Gold	33 Megohm, 5 %
Yellow, Violet, Yellow, Silver	470 Kohms, 10%

Fig. 4. Examples of the color code.

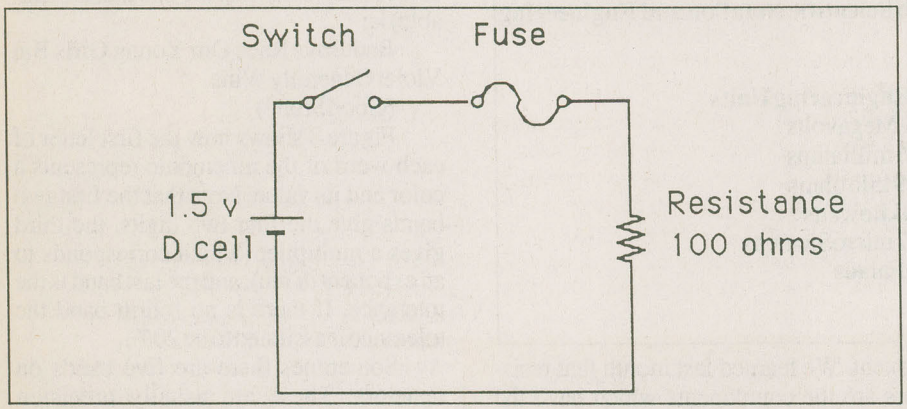


Fig. 5. A series circuit.

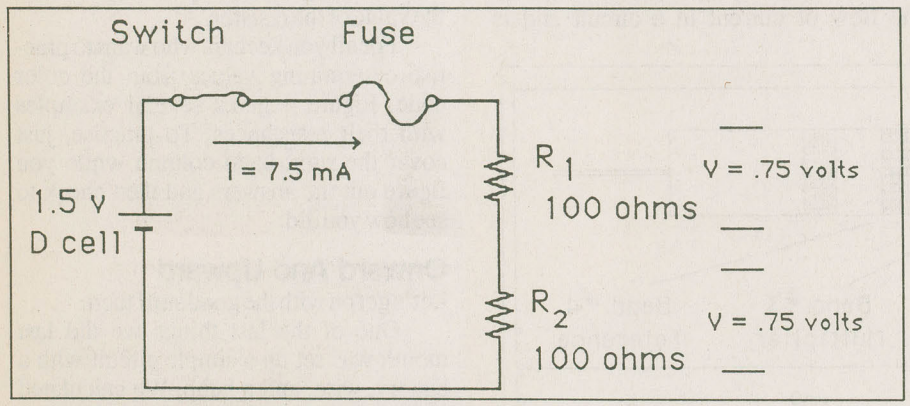


Fig. 6. A series circuit with two resistances.

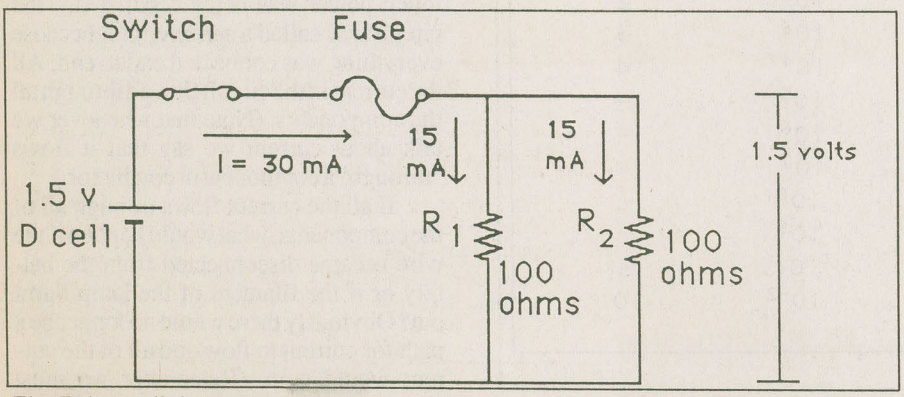


Fig. 7. A parallel circuit.

cuit.

In Figure 5 we have the same circuit, but now we have added a switch and a fuse. Both of these are used to create open circuits. The switch is there so you can turn the lamp on and off by interrupting the flow of current to it. The fuse is a safety device. It is constructed in such a way that if the current exceeds its rated value the internal link will melt and create an open circuit so that current can no longer flow. When the circuit is originally designed we determine what is the maximum current we would ever want to flow and choose a fuse with a current rating slightly higher than that. If the current ever reaches that level the internal link melts and current stops.

Kirchoff's Law: Adding Up To Nothing

Let's talk about voltage now. In the last issue we said that when voltage is supplied by a battery or other power source (called a *voltage rise*) we labelled it "E" and if we were talking about a voltage dropped across a resistor or other device we labelled it "V". We also said that, according to Ohm's Law: V = I X R, or we could say the voltage dropped across a resistor is equal to the resistance times the current through it.

If Ohm's Law is the most important, then the second most important concept in electricity is Kirchhoff's Voltage Law which states: *The sum of all the voltage rises and drops around a closed loop (circuit) will equal zero.*

Okay, don't get intimidated. This isn't Electricity 101. If you never remember the name Kirchhoff again it's really not that important. The important thing is the concept.

If we look at our circuit in Figure 5 (with the switch closed), we see that the battery supplies 1.5 volts. That is a voltage rise. We calculated last time that the current in the circuit was .015 amperes. (15mA according to engineering notation.) If we use Ohm's Law to multiply the current through the resistor times the resistance, we find that there is 1.5 volts dropped across the resistor. If we note the polarities of the battery and the voltage dropped across the resistor we will see that they are opposite, or oppose each other. If we add them algebraically the sum is zero.

Kirchhoff would be proud of us.

This may not seem very profound in a simple circuit, but it comes in very handy a little later on, so let's look at another simple circuit.

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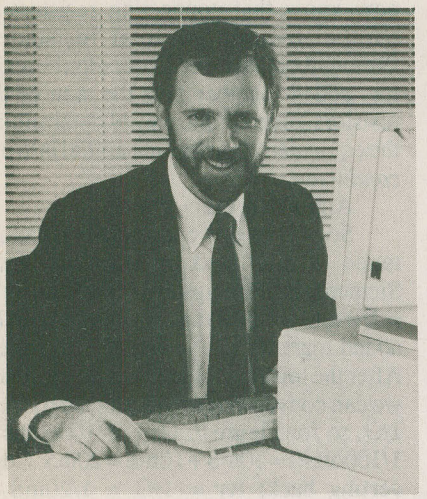

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The circuit in Figure 6 is still a series circuit. How do we know? Because there is only one path for current and so it flows through all of the circuit components. In this case, however, we have two resistances connected end to end. (Do you remember the old series Christmas tree lights? Because all of the current flowed through all of the lamps, if one burnt out, creating an open circuit, they *all* went out.)

Let's consider what the relationships between voltage, current and resistance are in this circuit. Has the source voltage changed? No, the battery is still a 1.5 volt cell. Has the circuit resistance changed? Yes, because now instead of one 100ohm resistor we have two. When two resistors are connected in series we can add their values to get the total resistance so: R_T = 100ohms + 100ohms = 200ohms.

If the resistance in the circuit has been doubled, what will happen to the current? Right, it will be one-half what it was before, because: I = V/R = 1.5V/200ohms = 7.5mA.

Now if we work backwards and multiply the current (7.5mA) times each of the resistors (100ohms), we find that each of them has .75 volts dropped across them. If we add those voltages up they will equal 1.5V which is the battery voltage. Again, Kirchhoff would smile approvingly.

We can call this circuit a *voltage divider* because the source voltage is divided between the two resistors. If the resistors were not the same values what would happen? A ratio of voltages would be dropped across them which would be proportional to the values of the resistors, and the total of the two voltage drops would always equal the source voltage.

Splitting The Current

Before we wrap up this month's segment we have to take a look at parallel circuits. Just as the name implies, the resistors in a parallel circuit are arranged in a parallel configuration (see Figure 7). Although you may not always see them drawn this way, if they are in parallel they can be redrawn such that they are parallel to each other because they will be connected together at both ends.

In the circuit in Figure 7 we can see that current will be sourced from the battery and will flow through R_1 (which originally was the resistance of our lamp filament). Because R_1 is connected directly across the battery, which is still 1.5 volts, and R_1 is still 100ohms, there should be: I = V/R = 1.5V/100ohms = 15mAmps.

Okay, I hear all those "but"s. You're saying "Why doesn't the current split and some of it flow through the other resistance?" Well, you are right. The current does split, but since R_2 is connected directly across R_1, and therefore the same 1.5 volts is also across R_2, there will also be 15mA flowing through R_2. If that is the case, then the battery must be sourcing both of those currents for a total of 30mA.

If the battery is supplying 30mA (15mA to each resistor), then what will Ohm's Law tell us about the overall resistance of the circuit?

R_{Total} = V/T = 1.5V/30mA = 50 ohms

The total circuit resistance is 50 ohms, one half that of each resistor. So we now know that connecting resistors in parallel *reduces* the total resistance. (Remember that in series circuits the resistors added together give the sum of the resistors.) The simple way of determining the equivalent resistors in parallel is to use *conductance*.

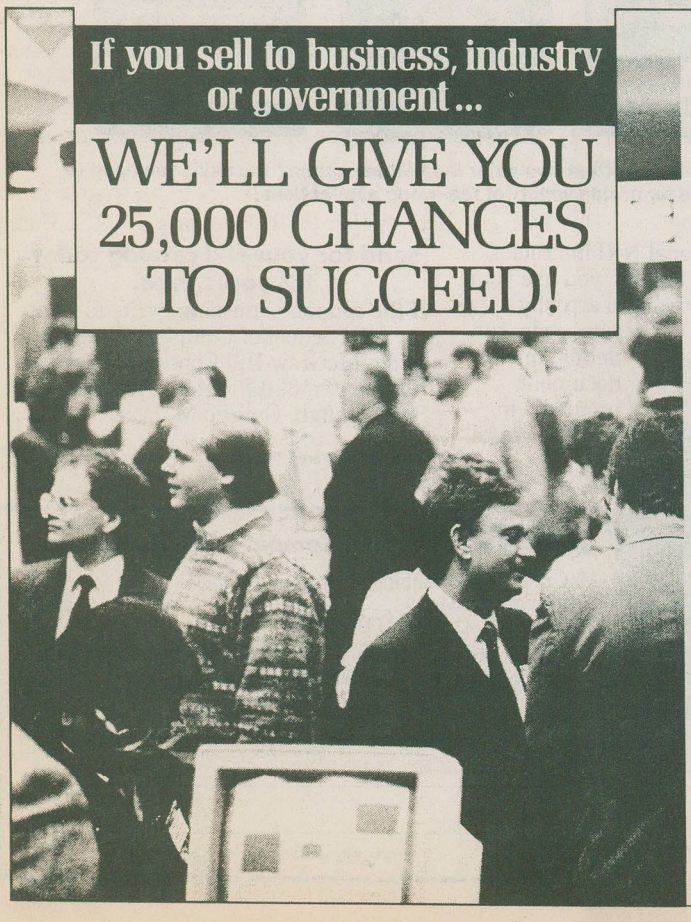
Arghh! Not more terms!

Sorry, but this one is easy. Conductance (symbolized by G, with units, Siemens) is the reciprocal of resistance: G = 1/R and conductances in parallel can be added together like resistances in series. After the total conductance is determined, we can convert back to resistance by: R = 1/G, so for Figure 7: G_T = 1/100ohms + 1/100ohms = 10mS + 10mS = 20mS. Converting back: R_T = 1/G = 1/20mS = 50ohms.

And that's what we determined it was before.

Enough. We can only take so many thrills at one time.

Next month we will look at series and parallel circuits together, short circuits, meters and how they are used, and tons of other good stuff. ■



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PROJECT

Using LCD Displays

Using the intelligent liquid crystal display in your projects.

Don Jackson

In the past few years the popularity of alphanumeric LCD displays has grown dramatically. This rapid growth can be traced to a number of characteristics which are very desirable in modern electronics. These features include: very low power requirements, small size, light weight, ease of use and availability. These devices have been around for some time but were very expensive; however, in the past few years several types have shown up on the surplus market (see side bar for the names of some suppliers of surplus units). This article is intended to show you how you can add intelligent alphanumeric displays to your projects.

General Information On LCD Displays

Photo 1 shows a 1 line x 40 character display, 1 line x 16 and a 2 line x 20 character display. These are of various manufacturers but all use the same controller IC. They all have a similar interface and use the same commands to control the display.

Photo 1

In general this type of LCD module contains a display, a driver IC and a controller IC. I will not go into the working of the LCD display itself, but would refer you to articles which have appeared in the trade journals. In a single line display each character field is ten rows x five columns and in a 2 line display the character fields are eight rows x five columns. To display ASCII data generally a format of 7 rows x 5 columns is used, as is typical for LED or CRT displays. In the LCD display the additional rows are used to show an underscore cursor and the descending tails on some of the characters.

I will concentrate on the interface and its requirements and the commands used to talk to the controller chips. Figure 1 shows the block diagram of a LCD device. The controller chip is a Hitachi HD44780 and the display driver is a HD44100. The chip numbers are given for reference only, as they are mounted on the back of the LCD module (see photo 2). Most manufacturers produce 16 character x 1 line modules which do not include a HD 44100 (such as Sanyo LM16155 or Hitachi LM020L). This type of device requires additional driver routines and is not supported by the software presented here.

The HD44780 is one of the newer LCD controller chips from Hitachi. It is used in several displays manufactured by OEM companies such as Optrex, Densitron Corporation, Philips, Stanley and some Epson devices as well as Hitachi's own line of units. This IC acts as the interface and LCD controller. The HD44100 is a driver chip and the number used is dependent on the number of characters in the display.

The HD44780 is a dot matrix LCD controller IC that displays the ASCII and

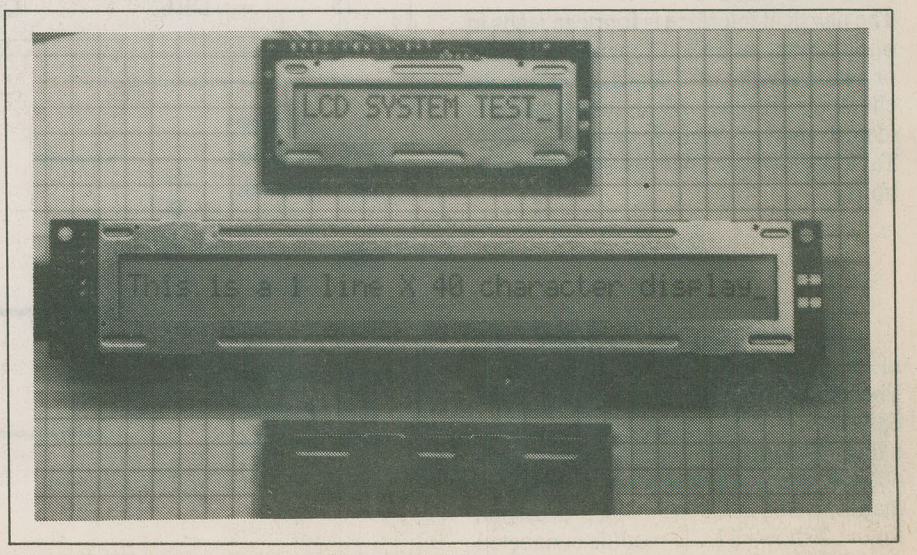


Photo 1. Three of the styles of LCDs available.

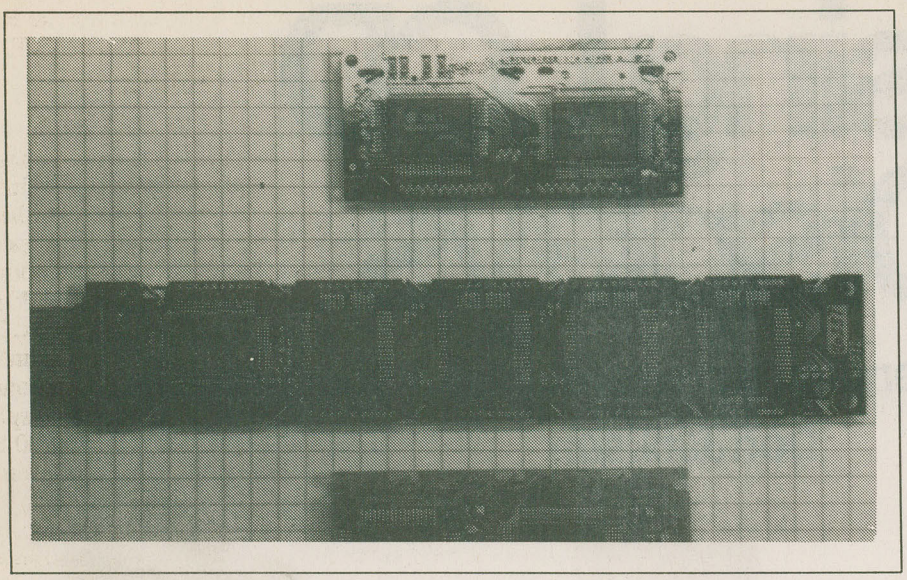


Photo 2. The rear view of the LCD displays shown in Fig. 1.

kana (Japanese) characters and symbols. The HD44780 contains a 80 byte display memory. This display memory is used to hold the data characters and the display acts as a window into this memory. In the case of a 16 character display the window shows 16 characters and the balance (64 characters or memory locations) is still available. By using commands supported in the HD44780 the display memory can shift through the window much the same way moving LED signs work. The HD44780 is a bus oriented unit and will operate in a 4 or 8 bit operation. I will only address the 8 bit operation of the unit as we will be attaching it to a 8 bit MPU.

The Interface

The physical interface is fourteen leads in one long row, as in the 16 character display or two columns of 7 leads, as in the 40 character display. Most manufacturers identify pin 1 and some mark pins 1 and 14. Table 1 shows the 14 leads and their functions.

The HD44780 will interface with most of the common microprocessors. The HD44780 is however tailored to the 680x and 650x bus structures. Hitachi has a large line of 680x chips. These include 6801/3, 6805s, 6804s, 6809, 68000 and their own line of CMOS 630x processors. Figure 2 shows a LCD module connected to a 6800 bus but the same general technique can be used for other processors.

Figure 2

Of the 14 interface leads only VO requires elaboration. This signal is used to control the viewing angle at which the display looks best. The viewing angle is important because just as in your LCD watch the intensity of the display will appear different depending on your viewing angle. To adjust the intensity of the LCD display a potentiometer is connected as shown in the schematic. A fixed resistor combination could be used but you will find that as the viewing angle of the display is changed the intensity may need to be adjusted. I have also seen an implementation where a thermistor is to control the VO to compensate for ambient temperature changes, however, I have never found this technique necessary.

The schematic shows a LCD (Hitcahi type H2572) display connected to a 6800 processor. I have used this because it is a

Table 1

Pin No	Symbol	Function
1	VVS	0 Volts (GND)
2	VDD	5 Volts (less than 1 mA, typ)
3	VO	See text
4	RS	Reg select (0=Command, 1=Data)
5	R/W	Read/Write (1-Read 0=Write)
6	E	Enable (Latched on falling edge of E)
7	DB0	Data bit 0
8	DB1	Data bit 1
9	DB2	Data bit 2
10		DB3 Data bit 3
11	DB4	Data bit 4
12	DB5	Data bit 5
13	DB6	Data bit 6

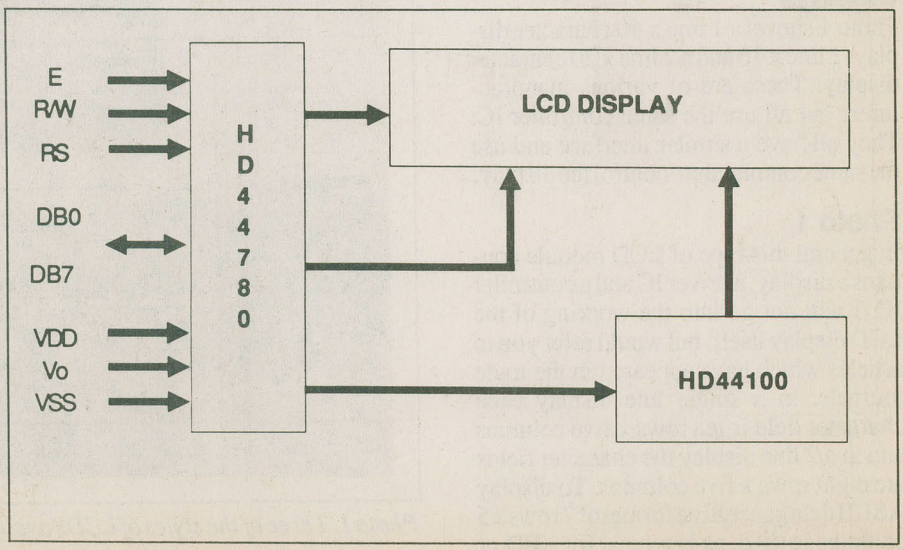


Figure 1. The basic connections for the logic.

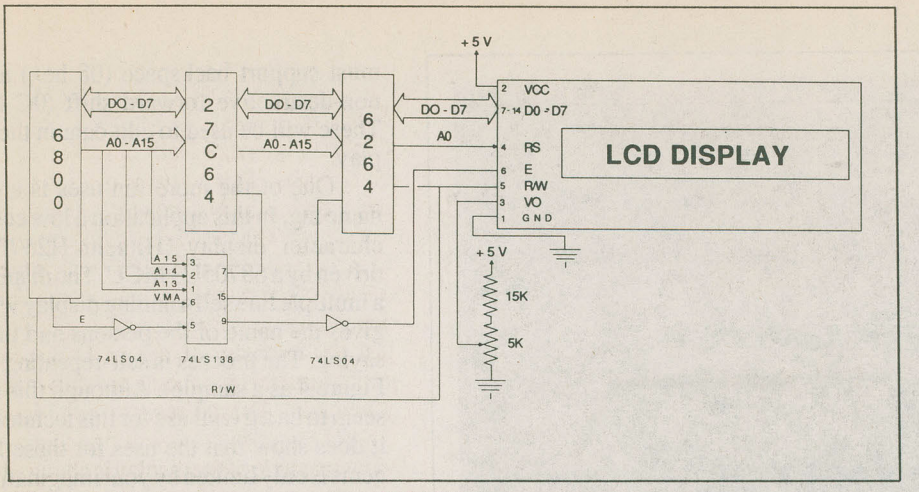


Figure 2. The interconnections to a 6800 CPU.

Table 2

Command	Function
01h	Clear display
02h	Move cursor to home
04h	Cursor moves left, display remains in position
05h	Cursor remains in position, display move right
06h	Cursor moves right, display remains in position
07h	Cursor remains in position, display moves left
08h	Display and cursor are turned off
0Ch	Display is on, cursor is off
0Eh	Display is on, underline cursor is on
0Fh	Display is on, box cursor blinks
10h	Shifts cursor one position left*
14h	Shifts cursor one position right*
18h	Shifts display and cursor to the left*

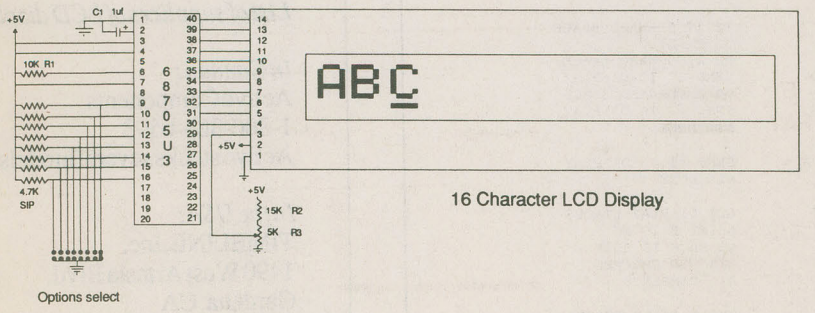


Figure 3. Pin connections.

fairly simple implementation. As this is a memory mapped processor system the display is addressed at C000 hex. Other components in the system are the RAM memory at address 0000 to 1FFF, the EPROM at E000 to FFFF.

Commands And Software

The HD44780 is a controller IC and is organized as two memory locations. In this schematic because the RS lead is on the A0 of the address bus the HD44780 responds to two consecutive addresses. The address selection is a function of the 74LS138 and the display is at C000 and C001 hex. The first address accesses the command register of the HD44780 and the second is the data register. To control the display, commands are sent to address C000 hex and data that is to be displayed is sent to C001 hex.

The HD44780 responds to several commands to control the interface and the display. These include commands to clear the display, position the cursor and change the font type. See Table 2 for a basic list of commands used to control the HD44780. The HD44780 also supports advanced functions such as user-definable characters. Space limitations do not permit exploring these now, however, you should obtain a copy of the manufacturer's data sheet for the device you are using. These commands are sent to the HD44780 on the MPU's write cycle. Each command has an execution time (see data sheet). During the execution of a command the HD44780 signals a busy state with a Busy Flag. This flag is the high order bit in the byte returned when the MPU does a read on the command register. If the eighth bit is high a busy state exists in the HD44780. If bit 8 is low the HD44780 is ready for the next command. The other seven data bits are the address at which the cursor is positioned in the 80 byte display memory.

An Application

Now that I have covered the operation of the HD44780, let's put the LCD display to work on an application. The application is a single line 40 character display on a 6800 based data display station. The schematic is the same as in Figure *. The key element is the software required to support the application. Before the code can be written it is necessary to define how the application will operate. I have chosen the following: the display will be initialized with the cursor at the righthand end of the display (display position 40 or 17h). As data is entered the display will shift to the left. The code

Using LCD Displays

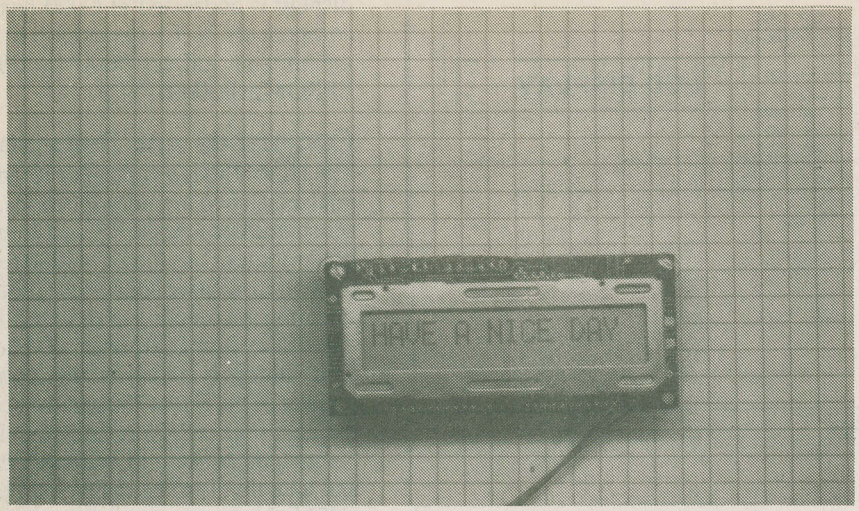


Photo 3. Programming the LCD for a message display.

```
*************************************************
*                                               *
* This is a 6800 program to display data on a   *
* 40 character by one line LCD Display.         *
*                                               *
*************************************************
*
          ORG  $1000        START OF RAM
*
LCDD      EQU   $C000         LCD DATA ADDR
LCDC      EQU   $C001         LCD CNTL ADDR
END       EQU   $05           END CHARACTER
BS        EQU   $08           BACK SPACE CHARACTER
FS        EQU   $0C           FORWARD CHARACTER
*
INCHAR    EQU   $E1AC         IN CHARACTER
MON       EQU   $E0E3         MONITOR START
DISPLAY   EQU   $A400         DISPLAY ADDRESS
*
*************************************************
*
*
START     JMP   INIT          INIT DISPLAY
*
MAIN      JSR   INCHAR        GET A CHARACTER
          CMPA  #END          EXIT?
          BNE   TEST1         DO MORE WORK
          JMP   MON           GOTO MONITOR
TEST1     CMPA  #BS           IS IT A BACKSPACE
          BNE   TEST2         DO MORE
          LDAA  #$1C          DO A BACK SPACE
          JSR   OUTCMD        SEND IT TO DISPLAY
          LDAA  #$10          DO A SPACE
          JSR   OUTCMD        SEND IT TO DISPLAY
          JMP   MAIN          ALL DONE
*
TEST2     CMPA  #FS           IS IT FORWARD SPACE
          BNE   TEST3         DO MORE
          LDAA  #$14          DO A FORWARD SPACE
          JSR   OUTCMD        SEND IT TO DISPLAY
          LDAA  #$18          DO A FORWARD SPACE
          JSR   OUTCMD        SEND IT TO DISPLAY
          JMP   MAIN          ALL DONE
*
TEST3     JSR   OUTDATA       SEND IT TO DISPLAY
          JMP   MAIN          ALL DONE
*
OUTCMD    LDAB DISPLAY        GET DISPLAY STATUS
          ASLB                SHIFT B TO CC
          BCS  OUTCMD         GO BACK IF BUSY
          STAA DISPLAY        SEND TO CMD REG.
          RTS                 ALL COMPLETE
*
OUTDATA   LDAB DISPLAY        GET DISPLAY STATUS
          ASLB                SHIFT B TO CC
          BCS  OUTDATA        GO BACK IF BUSY
          STAA DISPLAY+1      SEND TO DATA REG.
          RTS                 ALL COMPLETE
*
INIT      LDAA #$01           LOAD CLEAR CMD
          JSR  OUTCMD         SEND TO DISPLAY
          LDAA #$0E           LOAD DISPLAY CMD
          JSR  OUTCMD         SEND TO DISPLAY
          LDAA #$A7           LOAD POSITION CMD
          JSR  OUTCMD         SEND TO DISPLAY
          LDAA #$07           LOAD CURSOR CMD
          JSR  OUTCMD         SEND TO DISPLAY
          JMP   MAIN          ALL DONE
```

Listing 1. The source code.

must support backspace (08 hex) and a non-destructive forward shift (0C hex). These will be used to edit data in the display.

One of the more fun uses is a desk name tag. In this application a low cost 16 character display (Hitachi H2570) is driven by a 68705U3 MCU. The display is a multiple line self-running display which gives the name of the persons and then a saying. The process is self-repeating (see Figure 4 as a sample). Although this may seem to ba a trivial use for this technology it does show that the uses for these little gems is only limited by your imagination.

This is the desk of John Dow Display 1

Have a nice day Display 2

I am on vacation if you need help please see my manager Display x

The schematic is very straightforward.. The 8 data bits if the LCD interface are driven by port A of the MCU. The control leads (RS, R/W and E) are driven by bits 5, 6 and 7 of Port B. Port C is a 8 bit input port used to select which sayings are to be displayed.

The MC68705 MCU is available preprogrammed with the buyer's name from:

Canadian Command and Control
P.O. Box 451
West Hill, ON
M1E 4Y9
Canada

List of suppliers of LCD displays:

In Canada:
Active Components
1-800-363-6593
Active stocks several models.

In the USA:
TIMELINE, Inc.
1490 West Artesia Blvd.
Gardena, CA
90247
(213) 217-8912

R&D Electronics
1224 Prospect Ave.
Cleveland, OH
44115
(216) 621-1121

Figure 3

Due to space limitations the software can not be presented here; however, a copy (for personal use only) can be obtained from the author (*write Don Jackson c/o E&TT, 1300 Don Mills Rd., Toronto, Ontario M3B 3M8*). Programmed MPUs customized to the buyer's requirements are also available. The MPU is programmed with the buyer's name and multiple sayings. The 8 bit input switch selects which sayings are to be displayed.

If you plan to write your own code to drive an LCD display from an I/O port it is important to ensure that the port and the LCD are never both programmed for output at the same time as this could damage one or the other.

Conclusion

I have covered the interface requirements to attach the LCD module to a MPU system, the commands used to control the LCD display and a typical software example. Other uses for this type of display include output I/O on MPU controlled test equipment, dis[playing information on environment (i.e. temperature and time), remote display stations on a Home Information Net just to mention a few. These little gems are a super advent of the electronics available to the hobbyist today and I'm sure you will find many uses for these in your projects. ■

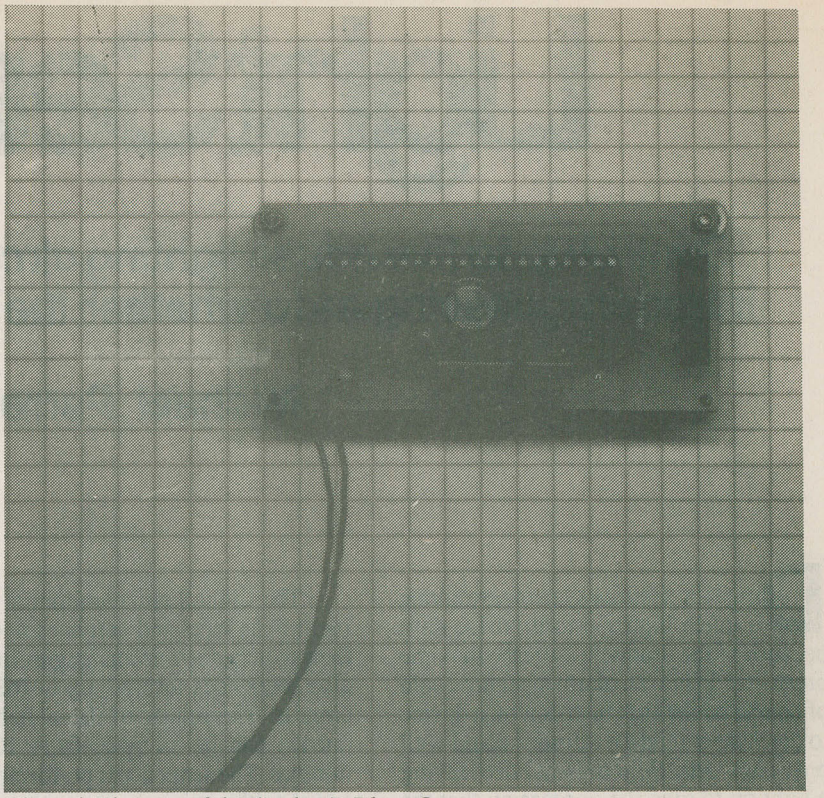


Photo 4. The rear of the display in Photo 3.

"My phone has been bugged....I want you to find the guilty party and put him in charge of the Data Base Computer."

PROJECT

Light Sentinel

Control up to five house lighting circuits and keep would-be intruders guessing as to whether the home is occupied or not.

Michael Perrow

Domestic security systems are taking a much higher priority these days because of the dramatic increase in home break-ins. While an alarm system should of course be the first investment, a device to deter the would-be intruder could well prove its worth. Police also advise leaving a light on to give the impression that the home is occupied.

This is good advice, but the idea can be enhanced with the Light Sentinel described here. The unit provides the means of remotely controlling up to five lighting circuits using the safety of low voltage switching signals that trigger a small interface unit fitted in each wall light switch.

The Light Sentinel monitors the ambient light level and activates at dusk. It then switches on one main light circuit and also sequences through up to four other circuits. The timing of the switching sequence can be adjusted from 10 to 40 minutes. The sequence is performed twice and then the unit goes in to a "rest" state with all light circuits being extinguished.

This state remains until dawn, when the unit is automatically reset. For example, if the timing is set for, say, half hour intervals, the sequence will last for four hours. If the unit is activated at 8pm by the fall in the light level, the Sentinel will continue working until midnight. If the lighting circuits coupled to the unit include the bedroom, bathroom and stairs with the main circuit coupled to the living room, then the impression can be given that there is movement from room to room within the house.

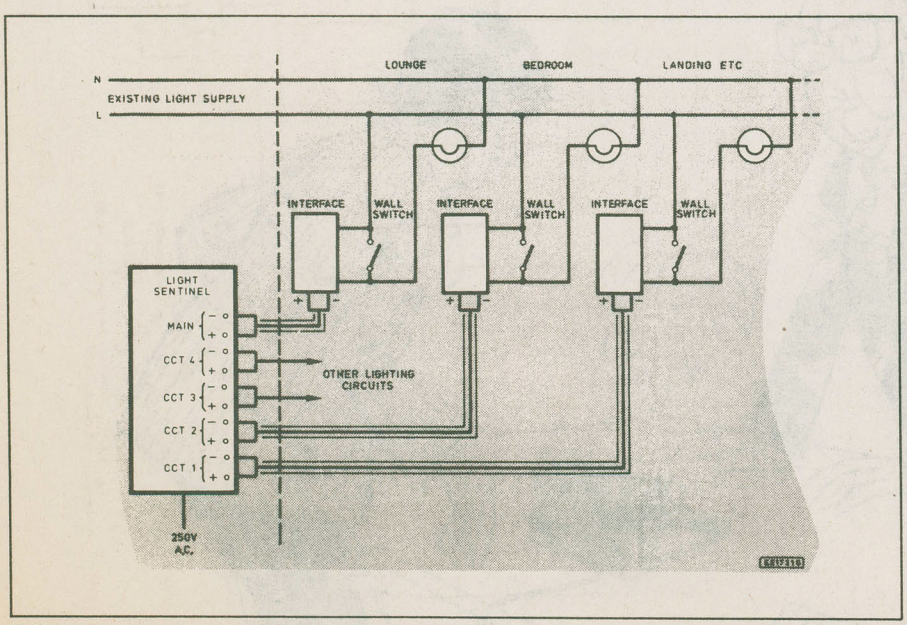


Fig. 1. The system block diagram for the Light Sentinel.

Power Control

Because we are using the lighting as a deterrent we can economize on power if we wish by running the lights at half power using a SCR (thyristor) interface; however, this will then exclude the means of controlling any fluorescent lighting circuits. If normal brightness is preferred, a solid state relay can be used for the interface.

Both these options provide a high degree of safety because only low level signals are sent out of the main unit using two-way cable, and are isolated from the AC supply at the light switch. This ensures that no lethal voltages are present between the unit and the lighting circuits.

The system block diagram in Fig. 1 gives the basic concept and shows how the unit is connected to the lighting circuits. As can be seen, the optical isolator and associated components are mounted on a small printed circuit board within the existing lighting box. If the solid state relay option is used, then this relay is all that is required within the light switch box.

Note that it is not necessary to couple up all circuits for the unit to operate and the switching sequence can be preset using link wires. This will be described later.

An additional facility is built into the unit which will flash all circuits on and off if triggered by a main burglar alarm. This is achieved by shorting out the Test switch

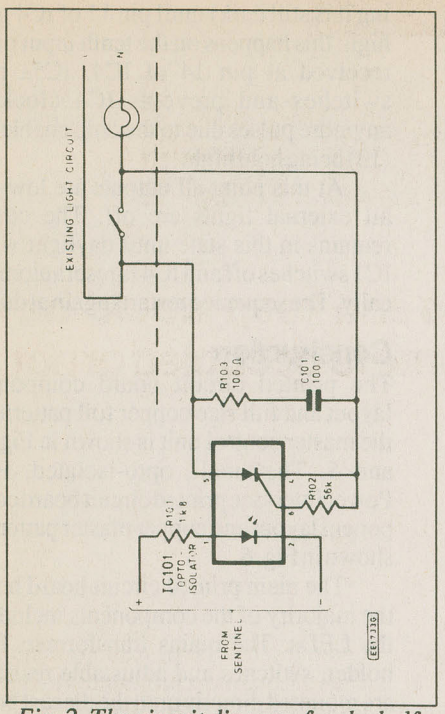


Fig. 2. The circuit diagram for the half-power option.

S1 with a pair of contacts from the main burglar alarm.

Circuit Description

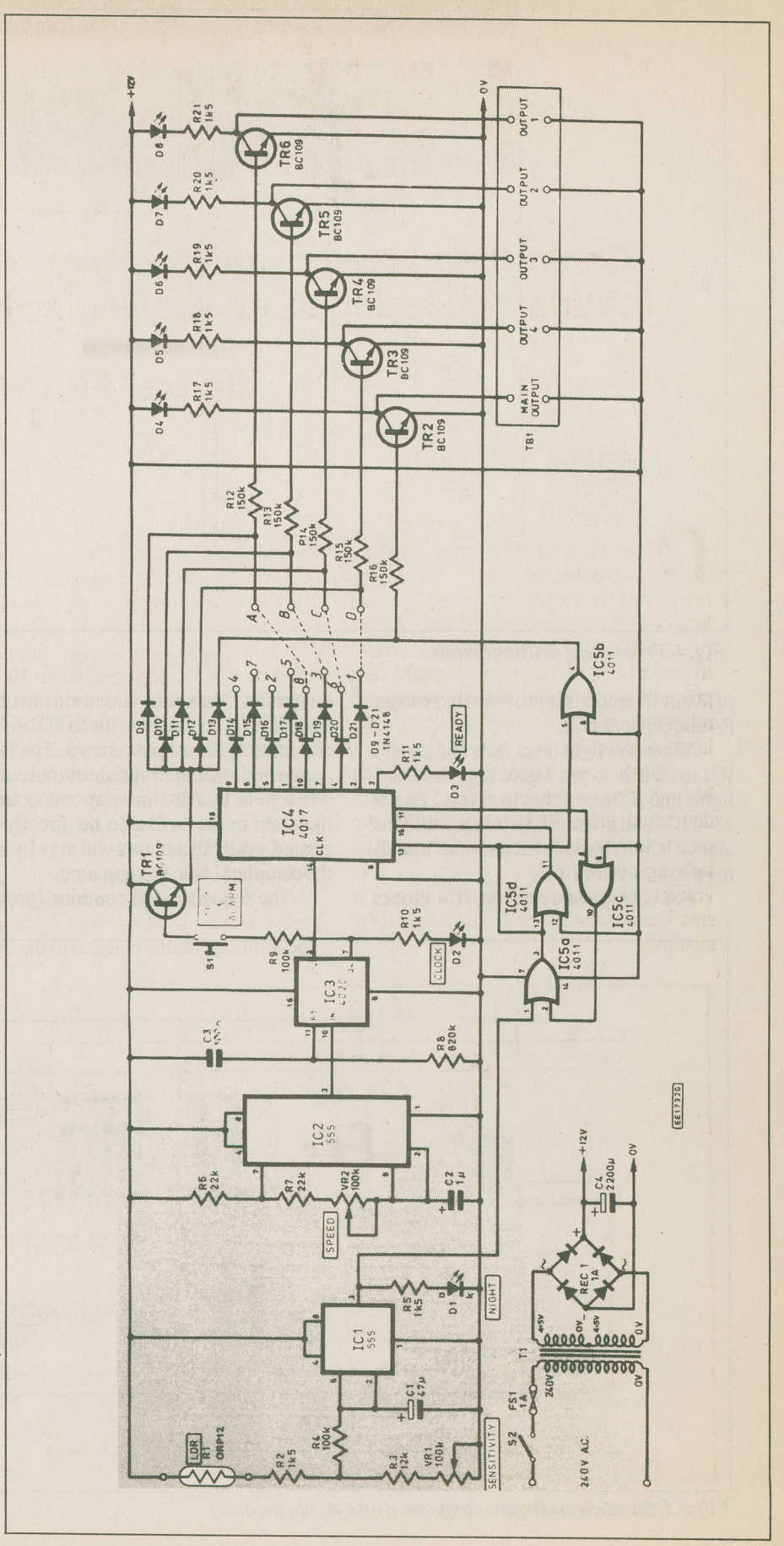
The full circuit diagram of the Light Sentinel is shown in Fig. 2 and the Half Power Interface in Fig. 3. When the unit is first switched on, during daylight conditions, the output from pin 3 of IC1 is low (0). This is coupled via IC5a to give a 1 (high) on pin 13 of IC4 and via IC5a and IC5d to give a 0 on pin 15 of IC4 which as a result is held in its reset state. At this point LED D3 is lit.

The oscillator IC2 is running and clocking pulses into IC3 which is a 14-bit binary counter. IC3, pin 7 is Q4 output and drives LED D2 to indicate that the oscillator is working. This output also has another use. If switch S1 is closed transistor TR1 is switched on and off as Q4 goes high and low. This is coupled via diodes D9 to D13 to the output circuits to enable a lamp test facility.

The unit is activated automatically due to R1, the light dependent resistor (LDR), sensing the change in the light level. As the light level falls, the resistance of R1 increases.

The point at which IC1, the light switching circuit, activates is set by potentiometer VR1. To provide protection from temporary increases and decreases of light, say from car headlights, a time delay

Fig. 3 (right) The complete circuit diagram for the Light Sentinel.



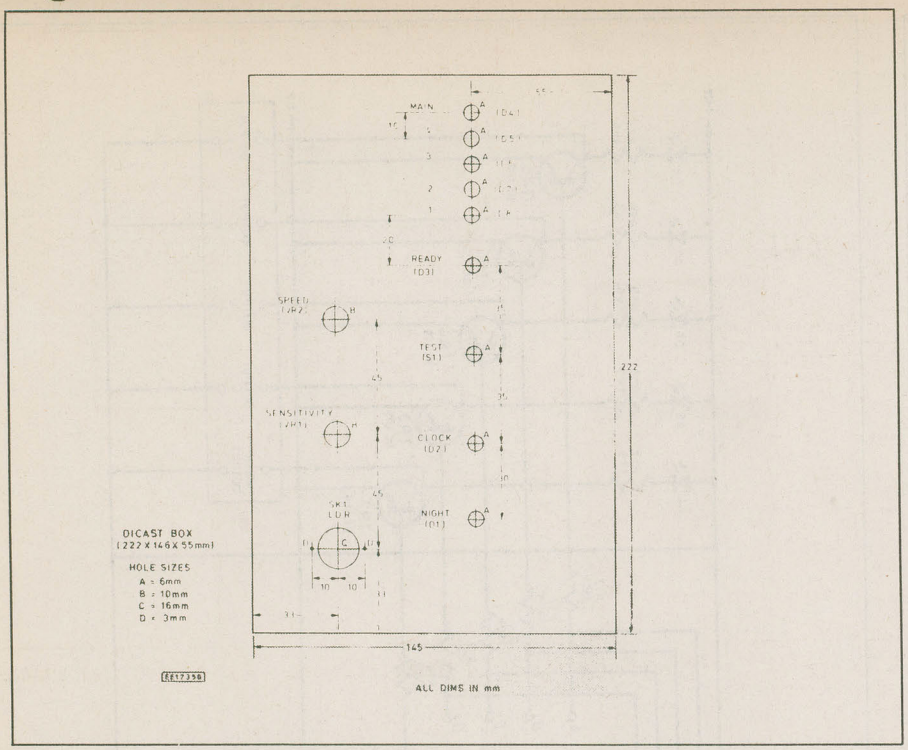


Fig. 4. Front panel drilling details.

of about 10 seconds is provided by resistor R4 and capacitor C1.

When the light level falls and causes IC1 to switch — pin 3 goes high, LED D1 lights and IC5a switches to give a 1 on pin 13 of IC4 and a 0 on pin 15 (via IC5d). This allows IC4 to be enabled and start counting the pulses from IC3.

For each pulse received, IC4 clocks on one, and each of its outputs in turn goes high. This is coupled via diodes D14-D21 and links to the output circuits. The lamp connected to the appropriate output circuit will now be lit. Also the lamp connected to the main output will also be directly activated via IC5b and this will stay lit until the complete cycle is completed.

The sequence will continue (providing it is still dark) until pin 11 of IC4 goes high: this happens on the tenth input pulse received at pin 14 of IC4. IC5a now switches and prevents IC4 clocking anymore pulses due to the chip enable pin (13) being held high.

At this point all outputs are low and all external lights are off. The circuit remains in this state until daylight when IC1 switches off and IC4 is reset automatically. The sequence restarts again at dusk.

Construction

The printed circuit board component layout and full size copper foil pattern for the master control unit is shown in Figs. 4 and 5. The small, opto-isolated, Half Power Interface printed circuit board component layout and copper master pattern is shown in Fig. 6.

The main printed circuit board holds the majority of the components including the LEDs. The mains transformer, fuse holder, switches and adjustable resistors are mounted directly onto the diecast box.

The cost of construction can be reduced if the alarm and test functions are not required. Just omit from the PCB the following items: diodes D9 to D13, transistor TR1, switch S1 and resistor R9.

Start construction by mounting all the components on to the main board, Fig. 4, in the normal order: links, resistors, capacitors and finally diodes, transistors and integrated circuits. The terminal block TB1 is mounted on the reverse side of the board.

If you refer to the component layout,

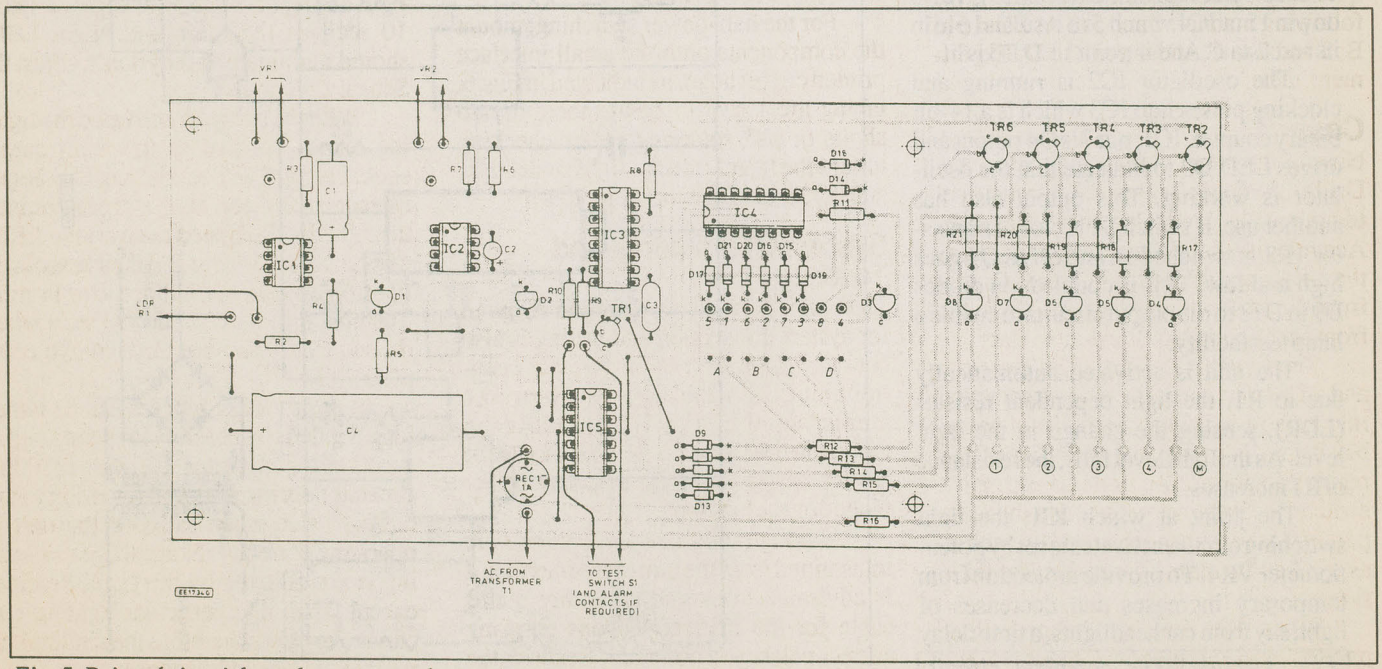


Fig. 5. Printed circuit board component layout (not to scale).

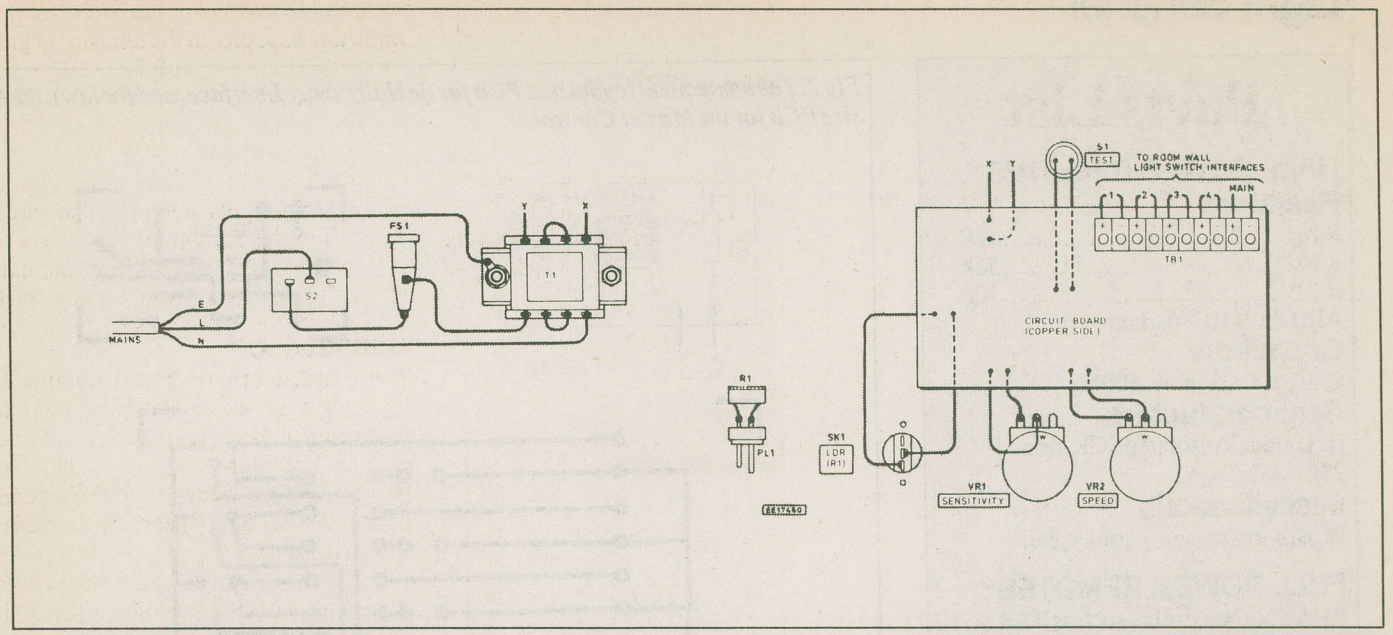


Fig. 6. Interwiring details from the main PCB. The LDR (R1) is mounted directly on PL1 during testing only. It should be wired remotely from the unit.

Fig. 4, you will see just below diodes D15 to D21 there are two sets of pads labelled *1* to *8* and *A* to *D*. These are to enable programming of the switching sequence. Numbers 1 to 8 refer to the outputs from IC4 and one flying link should be connected to each. The letters A to D are the pads connected to the output circuitry and each one can accept up to three inputs from IC4.

For starters try straight forward sequencing by connecting the links in the following manner: 1 and 5 to A; 2 and 6 to B; 3 and 7 to C, and 4 and 8 to D. Experiment later.

Case

Now to the metal work — the bit I hate. Drill all the necessary holes, the front panel template (Fig. 7) should be used as a guide. Accuracy is essential for holes marked *A* as the LEDs are offered into these directly from the PCB which is mounted onto the front panel using four stand-off pillars.

The LDR (R1) is mounted remotely and wired into a speaker plug and plugged into a two-pin socket on the front panel. No layout is given for mounting of the mains transformer T1, fuse FS1 and mains switch S2. These are mounted in the main part of the metal case and are positioned so as to clear the main board when the lid is fitted.

When the box has been drilled, painted and components mounted the remaining wiring to the main PCB should be carried out, see Fig. 8. This completes the construction of the main unit and all that remains are the modifications to the existing lighting switches.

Interface

For the full power interface, there is no construction required as the solid state relay has internal components to ensure correct operation. All that is required is to mount the relay into the switch box and wire it up as shown in Fig. 1.

For the half-power switching, mount the components onto the small interface printed circuit board as indicated in Fig. 6, taking great care to ensure there are no shorts or bad soldering. After checking mount the board into the light switch box and wire it up as shown in Fig. 1.

System Connection And Testing

The majority of the information required for system connection and testing is also contained in Fig. 1. Mount the master control unit in a suitable position near to a mains supply. The LDR should be mounted near a window and should be shielded from any light that may be activated by the Sentinel.

Although only low level signals are transmitted from the unit to the interface it is advisable to use good quality mains cable for the interconnections ensuring correct polarity is observed. Recheck the installation before applying power. Set the Sensitivity control to maximum and the Speed control to minimum (quickest cycling speed).

On powering up the unit during daylight, the following LEDs should light: Ready, Night, Main and Clock. The speed of the Clock LED flash should be adjustable with the Speed control. After about 10 seconds the Night and the Main LEDs will be extinguished.

Cover the LDR (R1) to cut off the light falling on it and after approximately 10 seconds the Main and Night LEDs should illuminate. If they don't, adjust the Sensitivity control.

With the unit now activated the lighting circuit coupled to the main output should be lit. The Sentinel has now begun its sequencing and after a predetermined time (set by the Speed control) the LEDs numbered one to four and their associated lighting circuits should activate in turn. The unit goes back to the rest state when the sequence has been through two complete cycles.

As this testing process can be rather long winded it is possible to speed it up by substituting capacitor C2 with a 100nF capacitor during tests and reverting to the correct value when satisfied the unit is operating correctly. Normal light switching is not affected by the Light Sentinel except when that particular lighting circuit is triggered; therefore the wall switch will have its normal response.

Parts List

HALF POWER REMOTES

Resistors

R101 .....1k8
R102 .....56k
R103 100
All 0.25W 10% carbon

Capacitors

C101 100n ceramic 400V

Semiconductors

IC1 optically isolated SCR, min. 230V AC, 3A

Miscellaneous

PCB, wire (see text), solder, etc.

FULL POWER REMOTES

RLA Solid state relay such as P&B EOTZ-240D15 or Crydom D2W202F.

MASTER CONTROL

Resistors

R1 light dependent resistor such as ORP12, Radio Shack 276-116, or Clairex CL5M7
R2,5 1k5
R3 12k
R4,9 100k
R6,7 22k
R8 820k
R10,11 1k5
R12-16 150k
R17-21 1k5
All 0.25W 10% carbon

Potentiometers

VR1 ..... 100k lin
VR2 .....100k lin

Capacitors

C1 .....47u elec. 25V
C2 ..... 1u tantalum 10V
C3 .....100n
C4 .....2200u elec. 40V

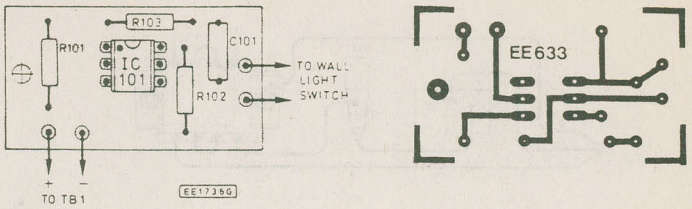
Semiconductors

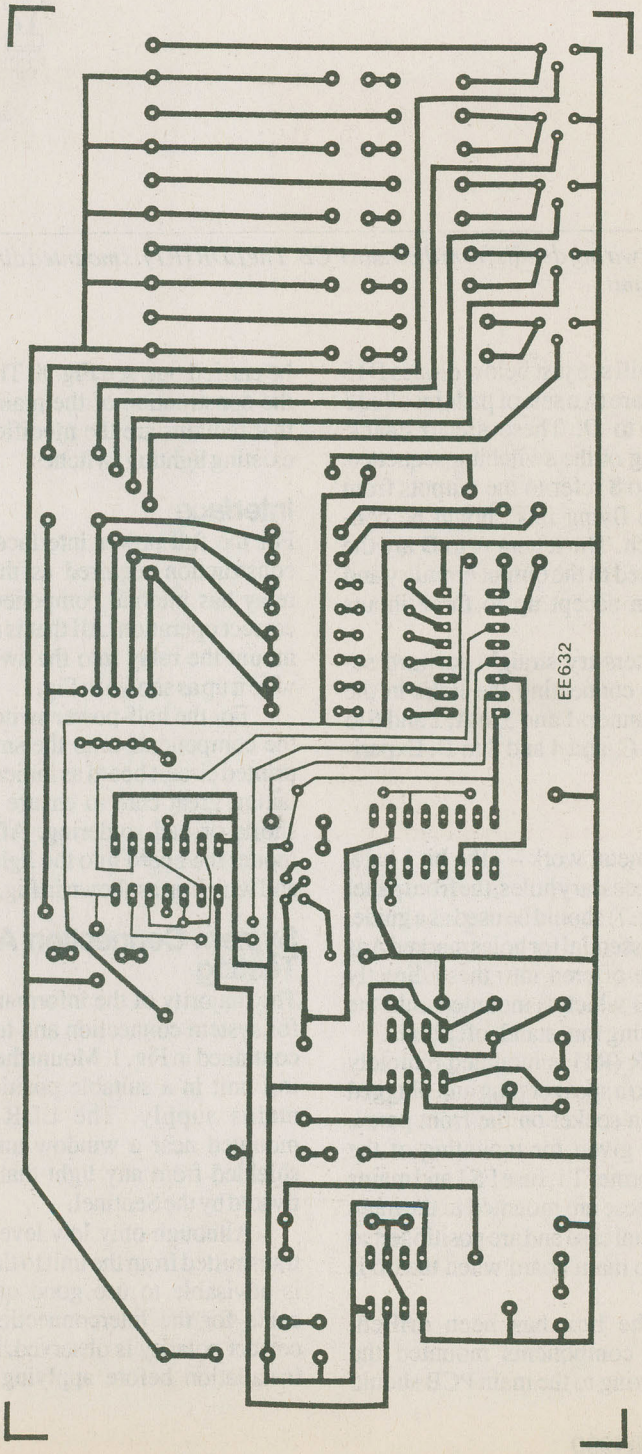
D1-D8 Red LEDs
D9-D21 ..... 1N4148 diode
REC1 .....1A bridge rectifier
TR1-6 ..... BC109, 2N3904
IC1,IC2 .....555 timer
IC3 .....4020 14-stage binary counter
IC4 .....4017 decade counter
IC5 ...4011 quad 2-input NAND gate

Miscellaneous

S1 .....push-to-make switch
S2 .....power switch
T1 power transformer; 115VAC primary, 4.5V-0-4.5V or 5-0-5 (0.5A) sec., such as Hammond 166G9 or 166G10.

Fig 7. The component layout and PCB for tje Half Power Interface, and (below), the full-size PCB for the Master Control.





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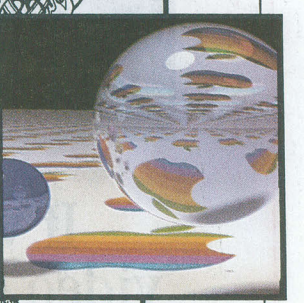

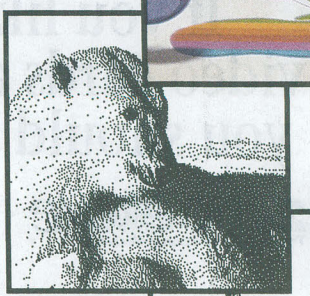

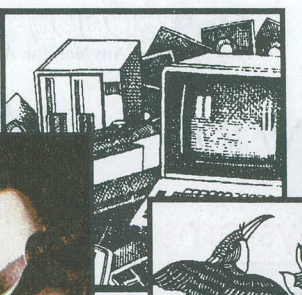

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CROSSALL is a tiny but remarkably useful command. It will run any other command or program in every subdirectory of your hard drive.

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ASTROVIEW will show you the skies... or more precisely, the stars... for any day of the year from anywhere on earth. It's interactive and very, very interesting.

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MUGSHOTS is not terribly useful but it is a lot of fun. It allows you to create composite pictures of faces from a list of standardized components. Included are a number of sample faces in case you can't find one of your own.

GRAPHIC WORKSHOP is the last word in graphics programs. It views, converts, dithers, halftones and prints all popular image files. It works with MacPaint, GEM/Ventura IMG, PC Paintbrush PCX, GIF, TIFF and EPS files and drives CGA, Hercules, EGA, VGA, ATI VGA Wonder and Paradise cards. It's an indispensible tool for graphics in desktop publishing.

CARDEX is an electronic simulation of a Rolodex file. It's actually a sort of canned database manager specifically for the sorts of things you'd normally write on cards. This is a great tool for anyone who keeps a lot of lists or piles of papers.

FICTIONARY is a game for anyone who likes unusual words. It has buckets of them. The object of the game is to figure which clue matches a particular obscure term.

MOUSE LISTER is a file browser with teeth. It uses an elegant mouse interface to make prowling through text or binary files effortless.

FORTUNE COOKIE is an essential Windows application for anyone who feels his or her sanity slipping into the twilight zone from time to time. It's a window which sits there and displays selections from its inexhaustible database of canned wisdom. Requires Microsoft Windows.

WINWHERE is a first class little file finder for Windows. It will locate any file spec and draw you a map of your hard disk to show you where the files in question are lurking. Requires Microsoft Windows.

CLOSER, RUN and CLEAN are a trio of tiny Windows utilities which will allow you to deal with frequently run applications quickly and without a lot of extraneous clicking. Requires Microsoft Windows.

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MEMORY is a Windows program which will show you how much DOS, extended and expanded memory Windows thinks you have free.

HANOI is a graphic demonstration of the solution to the legendary Towers of Hanoi problem. Requires Microsoft Windows.

FIFTEEN is the classic number puzzle done for Windows. It's a great little time waster when you can't face Excel for one minute longer. Requires Microsoft Windows.

TREK is a classic Star Trek game made bolder still with the addition of EGA graphics. It's a rich, intricate adventure set against the backdrop of uncharted space. Sounds like a good plot for a TV show of some sort... Requires an EGA card.

GRAFCAT is the latest... and vastly expanded... version of our popular graphics catalog program. It prints 16 images to a page on any LaserJet compatible or PostScript printer, and works with a mixture of PCX, IMG, MacPaint and GIF files. The colour pictures get dithered. This is a great tool for users of desktop publishing software.

SPICE is an extensive cross reference generator for spices and herbs. It helps you choose spices which will best complement your food.

CREEPS is a one of those apparently simple but maddeningly addictive ASCII arcade games. Requires a few hours to burn as you scoot between the blocks blasting the creeps Requires a CGA, EGA or VGA card.

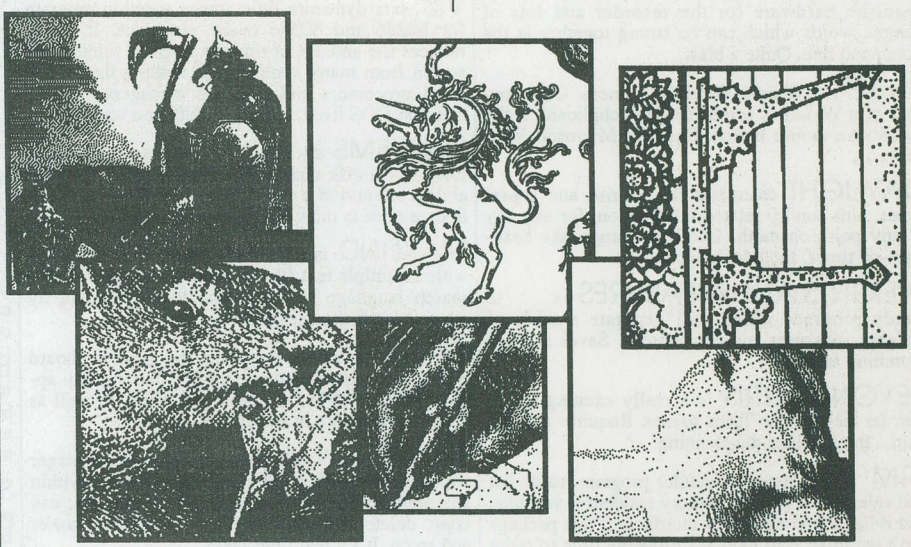
DIS86 is a diabolically clever machine language disassembler. It allows you to actually trace your way through the jumps and calls of a object file to see what everything does.

MOVE is a really reliable file mover. It copies your files from place to place and then deletes the originals.

LIFE is a really slick implementation of the classic simulation of life done for Windows.

VGAFONT will replace your boring IBM VGA font with a slick, modern looking one. Requires a VGA card.

ADULT TRIVIA is something like trivial pursuit with a one track mind. It's both entertaining and educational... and rude. Please note that this game is quite explicit in places... most places... and may not be suitable for young or sensitive users. If you plan to give this collection to the kids, we recommend that you delete this game.



DISK AT A GLANCE is a great little program for figuring out where all your hard drive space has gone. It lets you walk through your subdirectories and see what's stored where.

STARTER is a Windows application starter that's a lot easier to use than the main Windows screen if you use the same programs all the time. Requires Microsoft Windows.

WHEN is a time management tool which will let you set alarms for yourself, plan your days weeks ahead and generally make sense of a busy schedule.

HOTRES is a rather brilliant little program which will make any normal DOS program into a pop-up utility.

ALIAS is one of the most sophisticated DOS command line editors we've encountered to date. It replaces DOSEDIT with some powerful new functions.

REWRITE is a lifesaver for anyone who has a quad density, 1.2 megabyte drive. If you attempt to write to a regular 360 kilobyte disk in one of these things, it frequently becomes unreadable in a regular dual density drive. This program undoes the damage. C source is included.

CONQRDEX will generate a concordance index from any text file. It's great for creating book indexes and tables of content.

HOG is a glorious graphic pie chart which will visually display how your hard drive is being used. It spots the disk hogs. Requires an EGA card.

DQ is a file browser for database files. It works with DBF files from dBASE, FoxBase and all the other dBASE compatible programs. This is a genuinely essential program for anyone who works with database managers.

AGE will ask you questions about yourself and your lifestyle and tell you what your physiological age really is. It's rather sobering.

FREEKICK is a SideKick replacement. It provides you with a pop up calendar and calculator from within any application. However, it does so without tying up a lot of memory.

$24.95 (TWO DISK SET)

ALMOST FREE SOFTWARE
VOLUME 55

ASEASY is the latest version of the shareware spreadsheet package that has left the Lotus corporation shaking in its polyester boots. AsEasy is compatible with Lotus 1-2-3 and will use Lotus worksheet files. However, AsEasy is more powerful, easier to use and substantially cheaper. If you use Lotus you owe it to yourself to try AsEasy.

ATFLOPPY is a resident program which warns you if you attempt to write to a three hundred and sixty kilobyte floppy disk in a quad density AT drive. Saves considerable frustration.

WINDCHILL is a small program which calculates wind chill factors. This is a handy one to have when you want to justify staying inside during the winter.

QUOTE is a Windows application which says something clever each time it starts up. The clever things are stored in a dBASE compatible DBF file, allowing you to use them in other applications if you like. Requires Microsoft Windows.

TALK is the most sophisticated computer speech system we've encountered for the PC. It includes a program to speak real digitized words through the speaker, source code thereof, a program to record your own speech fragments, the schematic for the requisite hardware for the recorder and lots of sample words which can be strung together at the command line. Quite a blast.

SNAP is a simple Windows camera. Copy any part of a Windows screen into the clipboard at the touch of a mouse button. Requires Microsoft Windows.

DAYLIGHT calculates the sunrise and sunset times, plus sundry related information, for any day at any point on earth. Good for things like headlight-on times. Includes source code.

WEIGHTS AND MEASURES is a handy program which will generate a table of weights, measures and conversions. Saves a lot of thumbing around.

BEYOND TETRIS is a really exciting variation on the popular Tetris games. Requires a VGA card... the graphics are stunning.

RTM is a personal scheduler program, to-do list and calendar. It can be memory resident if you like, and it has a first class user interface. If this package can't organize your days it's probably time to retire to Tahiti.

START is an elegant way to start frequently used Windows applications. It's completely user configurable. Requires Microsoft Windows.

KWIKTAX is a beautifully executed 1989 Canadian income tax spreadsheet. It lets you work out your taxes as well as including features to let you try "what-if" calculations. If you're going to cheat, do it electronically. Requires the AsEasy spreadsheet package, included with this collection. Also runs under Lotus 1-2-3.

GENE is a genealogical program to help you trace your family tree. It goes back further than most people have relatives and includes fields for all sorts of interesting information about your antecedents.

$24.95 (TWO DISK SET)

ALMOST FREE SOFTWARE
VOLUME 54

SOAPBOX is a complete, exceedingly powerful word processor which is fast enough to use on a stock XT and small enough to run in 256 kilobytes of memory. It's capable of emulating WordStar... it will even read and write WordStar files if you like... and it's loaded with first rate text basing features that make it ideal for use with a desktop publishing package.

HOWTALL will take into account your child's sex, age and other factors and tell you how tall he or she should be.

WORLD is a truly amazing computerized atlas which will do more things than a paper atlas ever could, including providing extensive EGA graphic maps, calculating the distance between major cities and so on. An EGA card is required.

CUTPASTE will allow you to cut text out of one application and paste it into another. It's very flexible and extremely useful for desktop publishing, word processing and spreadsheets. Source code is included.

SPATH allows you to search for things along DOS's search path just like DOS does. A handy little tool, this.

VIZ is a dynamite little screen speedup program for 80286 and 80386 based machines. It vastly reduces the amount of time required to print to the screen from many applications, making things like word processors and database managers... not to mention DOS itself... seem to shift into warp drive.

EDISKEMS allows you to have a sophisticated EMS RAM disk with lots of features, including the ability to survive a warm boot with its data intact. Source code is included. Requires EMS.

MAXFIND is a great utility for finding strings within multiple text files. It includes a sophisticated search language to allow you to specify exactly what you want to search for.

ORGAN makes every key on your keyboard play a different note while you're running any application... or DOS. It's fun for a while, as well as being the ultimate in audible feedback.

EZDOSIT is a memory resident file manager which allows you to pop up a window from within any application and work with your files. You can copy, delete and rename files, change directories and so on. It's a real time saver.

DESKNAV is a Microsoft Windows program which provides a number of facilities which Windows didn't see fit to include. This is one of the nicest desk managers we've encountered to date. Requires Microsoft Windows.

LANCE is a prose style analyzer. Far from just telling you that you use too many possessive pronouns, it lets you test a text file for specific characteristics, including sexual bias and potential libel. No writer should be without it.

DECIDE is a simple program to let you try out a number of potential colour schemes for Microsoft Windows and select the one which best suits you. Neon is the house favourite. Requires Microsoft Windows.

PCMAN is a small EGA version of PacMan with all the speed of the arcade version. However, this one just gobbles dots, not quarters. It's sort of nostalgic.

$24.95 (TWO DISK SET)

ALMOST FREE SOFTWARE
VOLUME 53

MONOPOLY is a first class implementation of the board game. Requires an EGA card.

EMS is an expanded memory simulator. If you have an AT or 386 system with extended memory, this little jewel will make it appear as LIM expanded memory for applications which require it.

MT is an interesting resident program. It expands selected parts of the text on your screen into huge letters. Great for working late at night.

CROSSWORD lets you compose and play with crossword puzzles in style. Features a well thought out user interface and a sample puzzle. Requires Microsoft Windows.

MICKEY is a Windows screen clock which replaces the traditional Microsoft implementation with everyone's favourite fictional rodent. Requires Microsoft Windows.

RBREAK is somewhere between Breakout and Arkanoid. Requires Windows.

DKEY is a simple but powerful keyboard macro program, in many ways the equal of SuperKey and ProKey. Saves you ages of typing.

GRAFCAT prints hard copy of sixteen image files per page... along with their file names and such... so you can see what you've got at a glance. Requires a LaserJet Plus compatible printer.

FONTSUM will print up a summary page of all the LaserJet Plus soft fonts you have kicking around so you can tell what they all look like.

MAP will draw a map of all the hard drives on your system, telling you instantly how they're being utilized and how much space is free.

GRAVITY is a fascinating simulation of celestial mechanics. See how planets, stars and other celestial bodies interact in real time. Create your own universe... it's a blast.

EMCACHE is a memory cache program which runs in expanded memory. It can speed up hard disk operations, especially in applications such as database managers. However, it ties up no DOS memory doing so.

SCRABBLE is an implementation of the popular board game. Play against the computer. EGA card required.

POPHITS is a complete database of all the top forty singles and albums from the early sixties until the present, and with a snappy little query program to search the list by artist, album, year, and so on.

SCALEMASTER is a guitar tutor program which will blow your socks off. Aside from helping you tune the beast, it will show you how to play every imaginable scale in all keys.

MILLEBORNE is an eye-popping implementation of the classic travel game. Requires an EGA card.

SPACE is a slick little asteroids game for Microsoft Windows.

BIORHYTHM is a program to compute your personal biorhythms, displaying the results in full colour graphics. Requires an EGA card.

S-TREE is a directory tree mapping utility which will show you what you've got on your hard drive, where it is and how much space it occupies.

TVSAT is a great program if you have a satellite dish, as it tells you where the satellites are.

$24.95 (TWO DISK SET)

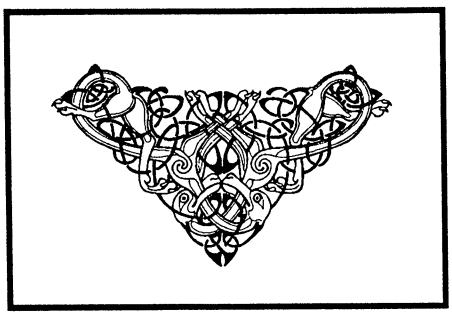
ALMOST FREE SOFTWARE
VOLUME 52

PC-AREA is the last word in telephone area code programs. Hit the alternate key of your choice and it pops up a window with all the provinces and states in North America, along with a comprehensive area code finder. Let your fingers hoof it in style.

FREEFORM is a data base manager for people who *don't* want to mess about with dBASE. It creates a free form data base which is easy to use, requires no set up and can be keyed by a trained chimp.

MAZE is a puzzle. It looks simple, but it's a real brain buster. The solution's included in case you get totally frustrated.

OHM-TSR is a handy pop up program which will work out resistor colour codes for you.



STACK is a DOSEDIT replacement from Australia. It keeps a stack of your previous command lines, plus it has a handy pop up window which lets you see all your previous commands at a glance.

CREDIT is a credit card manager, suitable for use in business or to keep track of your personal finances. It helps you refrain from spending yourself into oblivion. Don't leave home without it. Requires Microsoft Windows.

STAR GOOSE is a strange little arcade game in which you fly a space ship over a strange alien world blasting things into cosmic dust. It's fast and the graphics are superb. EGA or VGA card required.

ALMANAC is a computerized version of the old farmers' almanac that usually accosts you while waiting in the supermarket checkout. Find out what the best days to drill wells are, bring up a host of useful charts and tables and follow the phase of the moon.

VIEW2 is a file view program with schizophrenia. It lets you scroll through two files side by side, allowing you to compare them or just to work with two documents at once.

DUSTY is the last word in Ventura Publisher style sheet utilities. It will create an exhaustive analysis of any style sheet. If you use Ventura you won't want to miss this one.

KBSPEED speeds up the repeat rate of your keyboard... and suddenly, all sorts of programs seem to go a lot faster.

RETPLAN is an RRSP and annuity planner and calculator. It lets you see just how much you'll retire with based on your annual contributions. It's one of the last ways going to get something past the government.

$24.95 (TWO DISK SET)

ALMOST FREE SOFTWARE
VOLUME 51

ASCI is a great resident program for applications which require that you enter extended character codes into them. Rather than having to remember what the code for a U with an umlaut over it is, just pop up this window and select it from a table. Great for word processing.

DRAFTC is like AutoCAD without the price tag... and it doesn't need a math chip. This is a complete drafting package with pull down menus, mouse support and lots of features. It's great for applications in which you don't need all the power of a high end drawing program. Requires a mouse.

POLY is a really elegant little three voice music playing program which lets you compose songs with a text editor or word processor and halve them played through your PC's speaker in up to three voices. Sample songs are included.

TRICAL is the most sophisticated pop up calculator program yet devised. Outthinking SideKick and all the commercial calculators, this one will do things even real calculators can't get together.

BANANOID is staggering. It's a VGA game which makes Breakout not only interesting but addictive. Mere words fail to describe the limitless time wasting potential of this thing. Suffice it to say that if you own a VGA card and a mouse and go through this life never having play Bananoid, all future incarnations of your spirit will laugh at you behind your collective backs. Requires a VGA card and a mouse.

CLIP allows you to extract sections of GIF files and make them into new, smaller GIF files. It's a great tool if you use our POSTGIF program to create desktop publishing clip art from GIF files.

EGAINT is the last word in Tetris programs. The ultimate falling shape puzzle, this features colour, extended shapes and a plethora of exciting features. Requires an EGA card.

FREEMEM is a dandy little Windows program which puts a window on your screen to tell you the current amount of free memory available to your applications. No computer should be without one. Requires Windows.

NTERNIST is a fascinating and oftentimes useful package to help you figure out... if not cure... what ails you. Give it your symptoms and it'll try to diagnose your condition. This is *not* a substitute for a real physician, but it's great if the provincial health care plan has put you seventy-nine places back in the waiting list.

PUZZLE is a Windows program which takes one of several graphics, scrambles it into little bits and challenges you to re-assemble it. Quite a decent little program, this. Requires Windows

SUBMIT is an instant batch file. It allows you to run multiple commands at one time from the DOS prompt simply by separating them with colons. An essential gadget, this.

TIME puts a digital clock into a Windows screen.Takes up less space than the one with hands does, and it looks slick. Requires Windows.

TODDY is a DOSEDIT replacement. It adds a sophisticated command line editor to DOS to allow you to recall and edit previous commands. Saves buckets of typing and uses WordStar editing commands.

$24.95 (TWO DISK SET)

ALMOST FREE SOFTWARE
VOLUME 50

BAK will wander through your hard drive... every subdirectory, no matter how well buried it might be... and wipe out your BAK files.

CHAIN will tell you how much space any file on your disk occupies. This sounds like much ado about nothing, but CHAIN actually tells you how many clusters a file occupies, and, for the technically curious, where said clusters lie.

CUBE is a useless program that runs under Windows and displays a constantly rotating three dimensional cube. Despite its uselessness, everyone we know who has it runs it a lot... no idea why. Requires Windows.

DUNGEON is an ASCII game that lets you cruise through a complex, multiple layer dungeon picking up things and killing creatures. Requires that ANSI.SYS be installed.

IBM_SCRN is a downloadable character set for the Epson FX printers... and all compatibles... which emulates the PC's screen graphics characters. Make your screen dumps look like screen dumps rather than ASCII stew.

JOT-IT is the most flexible, interesting little resident note pad program we've come across. Loaded with features, it will find a warm place on your hard drive... right next to the platter bearings.

MINDREADER is the oddest word processor ever written. Especially designed for people who don't type too quickly, it uses artificial intelligence to attempt to anticipate what you'll say and fill in things for you. It sounds a bit far fetched, but the beast works.

POSTGIF is the latest version of this powerful program for turning GIF files into desktop publishing clip art.

PURGE is a handy little utility for selectively deleting files.

QCRT will speed up the screen speed of most machines by quite a bit. This makes DOS and many other programs which print through the BIOS really shift into overdrive.

SLITHER is a version of the popular snake game written especially for the EGA card. It's a bit warped, too... there's a frog involved. Requires an EGA or VGA card.

SPEED will speed up the screen display of an EGA or VGA card even better than QCRT, above. Includes the ASM source in case you like to hack.

CHEMVIEW is neat even if chemistry usually bores you into catatonia. It displays complex molecules in three dimensions and rotates them for you. Includes a selection of sample molecules. Requires EGA or VGA card.

FONTINFO is a DIR replacement that only wants to know about LaserJet soft fonts. It will find all of the soft fonts in a directory and tell you about them. Great for desktop publishing.

DROPCAPS are also great for desktop publishing. Consisting of twenty six little PCX files, they can be inhaled into Ventura, PageMaker... any package that uses the popular PC Paintbrush image file format... to provide you with beautiful, ornate large caps from A through Z.

THESAURUS is a computerized thesaurus program. Give it a word and it'll find you a selection of others that mean something like the same thing. Includes a huge dictionary.

$24.95 (TWO DISK SET)

ALMOST FREE SOFTWARE
VOLUME 49

PHONES is a Windows application which keeps track of telephone numbers... it'll even dial 'em for you if you have a modem. Requires Microsoft Windows.

BRAIN asks you lots of questions and evaluates how much of your thought processes are left brain, how much are right brain and how much are mixed brain. Requires a brain.

LM is the best mailing list program and label maker ever written. If you run a small business or send out newsletters, this program will change your perception of the universe. dBASE compatible.

ONEKEY is a keyboard macro program. It stores up to fifty strings, each one callable with the key combination of your choice. Ends buckets of repetitious typing.

ALDO is a game in the tradition of Mario Brothers. A little fellow with a beard leaps over barrels, climbs ladders and goes for the gold. Requires an EGA or VGA card.

POPDBF is a pop up utility which allows you to browse through dBASE, Clipper, Foxbase and compatible database files from within any application.

TIKLER is one of the nicest tickler programs we've encountered. It reminds you of up to three hundred events in the future, without knotted handkerchiefs, bits of string or things written on your arm.

CAITY is small and so brilliantly pointless that we had to include it. It's a resident program. Run it and it plays a different musical note for every key on your keyboard. It's a delight to listen to as you type DOS commands... a veritable symphony in WordStar.

CONNECT4 is the best and most ruthless computer implementation of this popular game.

PALETTE allows you to set the colour palette in Windows sensibly. If you don't know you need this program you don't know how badly you do. C language source code included. Requires Microsoft Windows.

LIFE is a three dimensional version of the classic program in which a colony of creatures lunch out on each other. A programmer's toy, the C language source code is included.

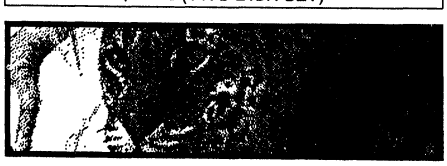
TRI-MAZE is a blast. It draws complex mazes and then challenges you to solve them.

PERIODIC displays the periodic table and lets you scan a cursor over it to get detailed information about each element. Requires an EGA or VGA card.

FANS Pilot a space ship through a field of waving fans catching bouncing loonie dollars as you go. An EGA or VGA card is required.

CHESS is a three dimensional chess game which actually allows you to move the pieces around, rather than just typing in co-ordinates. This has to be the last word in computer chess. Requires an EGA or VGA card.

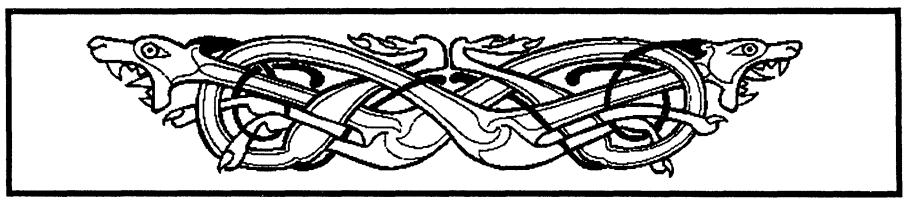
$24.95 (TWO DISK SET)



ALMOST FREE SOFTWARE
VOLUME 48

DRIVEL is a brilliant addition to any office. It produces very meaningful sounding text which is actually pure drivel. It will happily generate as much text as you want, suitable for use in memoranda, reports, letters and year end stockholders portfolios.

CPRINT is the ultimate C source file printer. Aside from generating first class hard copy listings complete with headers, footers, page numbers and so on, it will also generate an index and a table of contents for any source file.



EGARULE pops a ruler up over any EGA text screen. You can position the ruler where you need it, and use it for the accurate positioning of text in different applications. It's amazingly handy. Requires and EGA or VGA screen.

INVENTORY is a home or office inventory program which maintains a running database of your possessions. It keeps track of what everything's worth, and provides you with an estimate of the replacement costs. Reduces potential "negotiations" if you have to make an insurance claim.

JDOS will pop a command line up from within most applications. However, it does a number of clever things to allow you to have all the DOS memory in your system available for applications run from within other applications... quite the clever trick when you think about it.

MORTGAGE is a powerful mortgage program. It does a number of types of calculations, and will print hard copy reports. It's great for doing "what if" plans to find ways to slaughter your mortgage quicker.

PIZZA will teach you to make pizza at home. It contains a variety of recipes and tips. Avoid getting anchovies in your disk drives.

POSTGIF is the best way of generating black and white printouts from full colour GIF files. This program creates true halftones... not dithers... from GIF files and stores them as EPS (encapsulated PostScript) files. These can include previews for use with Ventura publisher, too... you can use GIF files as black and white art for desktop publishing. If you've tried our Colour Clipart disks, you'll want this program. Requires a PostScript printer.

SLEUTH is a fascinating graphic ASCII game. A murder has been committed in an old house. There are various odd characters around, and various clues. Your task is to wander around the various rooms, check out the clues and unmask the villain before you get crunched. The game changes with every playing, and you can use your own cast of characters if you like.

SORTDEM is a particularly interesting program. It illustrates the process for sorting a list of words using five of the most popular sorting algorithms. You can see how each one works, and you'll understand why each one is preferable for some applications. C language source code is included.

$19.95

ALMOST FREE SOFTWARE
VOLUME 47

LETTERS 'N LABELS is a fabulous mailing list manager if you have moderate sized lists to keep. It will store them in a custom database, let you update the list and print out labels whenever you need them.

ARGH is the sound that most people make after playing this puzzle game for a while. It's just a series of sliding blocks, but it'll drive you mad trying to solve it..

DERASE is the most comprehensive file uneraser we've seen so far. It handles everything from floppies to hard drives of up to thirty two megabytes, and it tells you if your files have been trashed and are therefore unrecoverable.

HPPS is a PrtSc replacement especially designed for owners of HP LaserJet Plus compatible laser printers. Includes ASM source.

FINDER is a Microsoft Windows utility which locates files anywhere on your hard drive.

DO-ONCE is a program which can be set up to run specific applications, utilities or batch files at specific times. It will, for example, automatically back your hard drive up to a streamer every Friday afternoon once everyone has gone home. This is the most flexible and reliable one of these things we've found to date.

LAST RESORT keeps you going when your computer hangs. It will get you back to DOS, copy the contents of a RAM disk onto something more permanent and restart your heart when your system appears to have locked up solid.

AXEL-F plays the theme from Beverly Hills Cop. It's not all that useful, to be sure, but it's small and fun. Requires BASIC.

LIFETIME is a serious program which uses solid statistical research to estimate your life span based on your health and lifestyle... it can be a bit sobering. Requires BASIC.

POPDATE is a really well executed pop up calendar which shows you the current, previous and next month for any month you like.

800K uses the high density drive of an AT or 386 based machine to format normal low cost dual density floppies to hold eight hundred kilobytes worth of data, or more than double their usual capacity. It's a great money saver, considering the price difference between these and quads. Includes ASM source.

GLEANERS is a complete index to National Geographic magazine from 1957 through to 1987, along with a really superb database program to search for things by subject, place and so on. It's great for research, and essential if you've been saving back copies for a while.

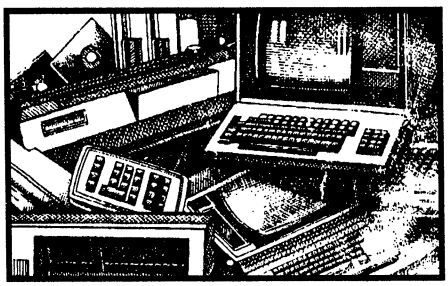
$19.95

ALMOST FREE SOFTWARE
VOLUME 46

PAINTER'S APPRENTICE This is a complete implementation of a MacPaint style paint box program for the PC, equal or superior in many ways to the original... and a lot easier to use than is PC Paintbrush or Microsoft Windows Paint. This is a phenomenally enjoyable program equally suitable for a bit of image hacking or for serious art. It's a must for desktop publishing. Requires EGA or VGA card and a mouse.

DGTERM is an immensely clever program which pops up a telecommunications terminal from within any application and allows for background XMODEM and YMODEM file transfers.

FINANCIAL PARTNER is a storehouse of financial planning utilities. It will work out amortization tables for loans, help you plan annuities and so on. No one with more than twelve dollars should be without this package.



FR386 is the fastest, slickest and most stunning fractal graphics package we've ever seen. It includes a zoom box which lets you move successively closer to the images you create. Requires an 80386 based computer and EGA or VGA card.

HPCALC runs under Microsoft Windows and gives you the complete functions of Hewlett Packard style programmable scientific calculator. No number will get away from you once you have this thing running.

LOOKFOR is a powerful text search utility which will find selected strings of text in any number of files. It's a useful research tool... and a great asset for people who can't remember where they last saw something.

QUIKCOPY is a replacement for the DOS DISKCOPY program. It copies disks in about half the time, and allows for multiple copies of the same disk without reading the original for each one.

RACECAR stands proudly in the tradition of brilliant public domain ASCII games. Using nothing more than text and colours, it allows you to drive a speeding car through a twisting, debris strewn race course until you finally pile up on the walls or oil slicks.

TIFFANY is the first really workable screen capture utility for Windows we've encountered. It allows you to create graphics files from any window on the screen.

TRAN is a rather astounding piece of work. It reads text files... through the speaker of your PC, in English.

ZAPDIR kills whole subdirectories in a single shot. It ends the annoying requirement of DOS that you manually wipe out all the files and sub-subdirectories in a subdirectory before you remove it.

$19.95

ALMOST FREE SOFTWARE
VOLUME 45

POPDOS2 is a pop up DOS shell. You can rename, delete, type and generally meddle with files from within any application. It can save your life when your disk is full and your file hasn't been saved.

CALLFOR is a resident equivalent of those pink message slips that proliferate around offices... just the thing for an over worked receptionist, especially one with bad hand writing. It can be popped up from within a word processor or other application when the phone rings.

CLEARCUT will scan your word processing files and suggest places wherein you've used more complicated wordings than you should have. It helps to simplify your writing and make it easier to read.

CONFMT is a resident disk formatter. It allows you to format floppy disks as a background task while you run normal programs. It's quite a time saver.

FLEES is like Space Invaders on acid. It's blindingly fast, with brilliant graphics and some really bizarre aspects. Requires an EGA or VGA card.

PALMEGA is a computerized palm analysis program. Better than an old lady with a crystal ball, it will tell you how long you'll live, how rich you'll get and whether or not you'll meet a tall, dark stranger who'll try to sell you swamp land in Florida. EGA or VGA card required.

P4UP will print four pages of normal text on a single sheet of paper on most laser and inkjet printers. It has a number of sophisticated formatting features, too.

SHFTPICK is ideal for people with a lot of resident programs on their hard drives. It allows you to hold down the Alt key and bypass loading them when your system boots up.

MDIAL is a memory resident dialer program and phone number database. Connected to a modem, it allows you to dial voice calls without actually touching a phone.

SMOOTH is the leading edge of text browsing programs. It will smooth-scroll back and forth through any text file. This may seem like overkill... well, it is, actually... but it's awfully neat to watch.

VALET is the best DOS shell program we've encountered. It will move, mass copy, delete, rename and generally handle the files on your hard drive in menu driven comfort. It's ideal if you don't like typing in commands.

WIPE totally destroys files on your disk so that they can never, never be restored and looked at again. It's an essential tool if you deal with sensitive data.

YEARCAL creates calendars for any month of any year of the twentieth century. However, it creates more sorts of calendars than you can possibly imagine... in sixteen languages, including Texan.

$19.95

ALMOST FREE SOFTWARE
VOLUME 44

BCOPY is one of the cleverest copying programs around. It hides in the background while it's working, so that immediately after issuing a copy command your DOS prompt returns and you're ready for whatever's next. A great little time saver.

BDS is a slick pop up electronic engineer's calculator. It handles things like wavelength, capacitance, radio equations and so on.

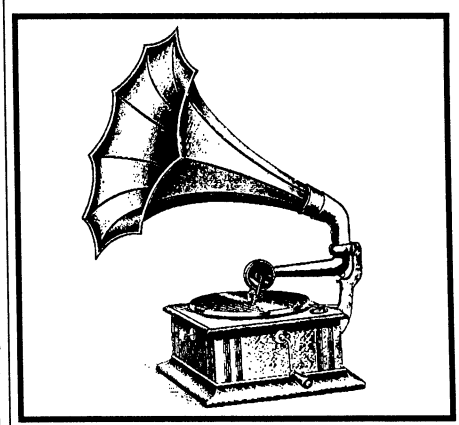
CALCQF analyzes your system and figures out how much you can speed things up by changing the refresh rate of your memory without crashing your machine. Then it generates a small COM file to include in your AUTOEXEC file.

JIVE translates any English text into jive.

LUM is a sophisticated sideways printing program which is great for speadsheets or any application wherein regular paper just isn't wide enough. It supports multiple fonts, effects and so on. Requires an Epson FX-80 compatible printer.

NJFRERAM will show you how much free memory you have from moment to moment up in the upper right corner of your screen. Great for spreadsheet users, amongst others.

ORDER changes the order in which files come off your disk when you type DIR. This allows you to pre-sort your directories, or adjust them in any order you like to make frequently used programs boot more rapidly.



PYRO we've had fireworks programs before... but this is the best. It does EGA fireworks, complete with sound effects, and is truly glorious. Includes C language source code. EGA/VGA card required.

SOT is the son of Tetris, the addictive game from the Soviet Union. This one is even more devious.

STYLIST is an essential tool for any Ventura Publisher user. It allows you to edit, manipulate and print out any style sheet.

TONTO is a SideKick-like program with a host of features, including a clock/calendar for any year since the middle of the sixteenth century, an ASCII chart and a printer setup program.

MR BOSTON is the ultimate bartender. It holds recipes and complete directions for zillions of mixed drinks... from the common to the delightfully bizarre... and provides you with an outstanding user friendly program to access and even add to the list.

$19.95

ALMOST FREE SOFTWARE
VOLUME 43

MAGMA is a truly weird graphic arcade cum adventure game. Tunnel through the depths of the earth, contact spies and try to assemble all the fragments of your secret document.

BANKER will keep your chequebook in balance... as well as anything short of divine intervention can.

FONTFILTER adds special effects to LaserJet softfonts. Included are such effects as drop shadows, enclosing boxes and even blood dripping from each character... no foolin'... Also includes the complete C source code.

READRITE is a real time readability analyzer. A resident program, you can pop it up from within your favourite word processor and get a readability index for the contents of your screen. Very slick.

CALC is the nicest pop up programmer's calculator we've encountered... and it's pretty hot for anyone else who has to deal with numbers too. It includes base conversion and a host of other useful functions.

Z80XASM has been requested by a number of our users. It's an assembler which runs on a PC compatible system but assembles ASM source code for the Z80 microprocessor. Includes a Z80 machine language monitor as a test file.

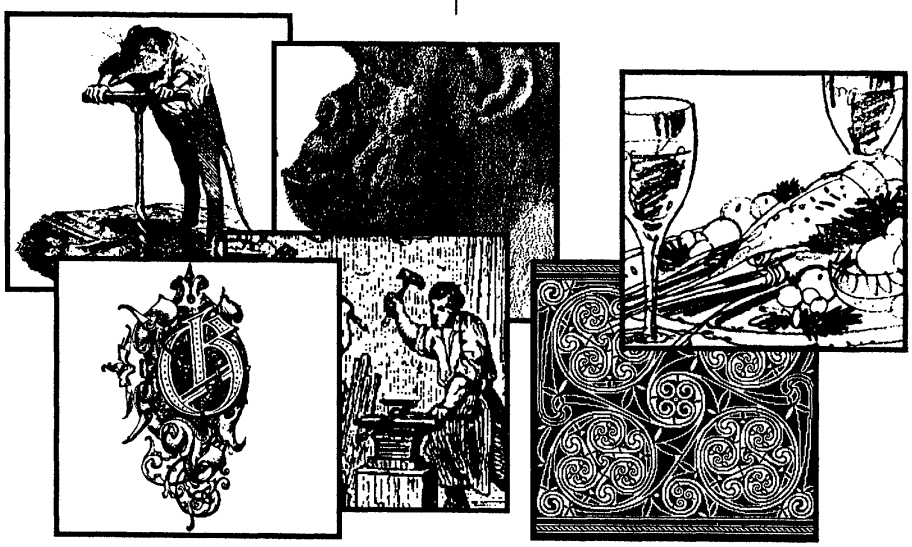
HERCSAVE is the most reliable Hercules screen blanker we've come across. Save those green screens.

FSEE is a quick and nasty way to see what LaserJet fonts look like without having to download them to a laser printer... it shows them on the screen of your PC in graphics mode. Handy for use with FONTFILTER, above.

OKSCR is a really elegant way to get reliable screen captures from graphics applications. More to the point, it actually works. Writes to PC Paintbrush compatible files.

VALSPEAK translates English into valley girl talk. Gag me with a spoon.

TED is a very small text editor... two kilobytes is very small. It's about the easiest little editor in creation for just whipping up a few lines of a batch file or changing a driver in your CONFIG.SYS file. It's also good for program editing.



CARDFILE is a little pop up database program which will keep track of people, places, phone numbers... it even dials your phone through a Hayes compatible modem.

RECORDER will keep track of the frequency of access of the files you use to help you decide how best to use a RAM disk.

BARMENUS is a system to compile and implement Lotus style menus in applications other than Lotus. It's a great toy for die hard 1-2- 3 users, and not a bad user interface for the rest of the planet.

SNIPPER is the slickest text cut and paste program we've encountered to date. Copy text from the screen of just about any application into just about any other one. Great for getting spreadsheets into your word processing documents.

SWEEP will execute any command you like in every sub directory of your hard drive.

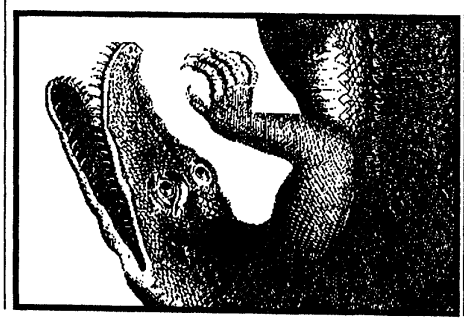
CONFIG is splendid. It lets you alter the way your CONFIG.SYS file is interpreted by DOS when your system boots up. You can exclude specific drivers at boot up time to free up memory space... no PC should be without it.

EGALINES is a collection of tiny utilities which will set your EGA card to different line sizes so you can see what text looks like in the higher resolution modes. Includes 12, 25, 35, 43 and 50 line modes.

EGAITAL puts your EGA screen in italics mode. Not blindingly useful, but only a hundred bytes long.

PCXSCOOP is a file reader and printer for PC Paintbrush PCX and PCC files. Let's you check 'em out without loading the whole ZSoft circus. Handy for use with OKSCR, above.

$19.95



ALMOST FREE SOFTWARE
VOLUME 42

FORMATQM is a very, very fast disk formatting program.

FIREWORK blanks the screen after a period of inactivity and shows you fireworks until you do something. Requires Microsoft Windows.

SNAKE is the best snake game ever written.

BELL makes the beep in your computer sound slick and sophisticated.

CALLTIME will dial the atomic clock in Ottawa and set your system clock accordingly. Requires a Hayes compatible modem.

CASE will change a text file to all upper or all lower case, strip the WordStar bits and several other things.

CDTO provides a simple way to locate files in other subdirectories and then go to their locations.

CLOCK is the biggest resident screen clock in creation.

DDATE is a cursor driven date setup program.

DEV shows you all your device drivers.

KTIMER times the execution of any program to the nearest hundredth of a second.

LISTFRAG shows you how fragmented your hard drive is, allowing you to decide whether it's worth running a defragmenter program.

NREFRESH slows down the refresh rate of your system to increase the speed of your machine.

RAMVIEW is a resident program that lets you pop into a hex and ASCII dump of your system and page through your RAM.

REPEATS locates identical files in a complex hard drive system, allowing you to free up some disk space.

SETALARM wakes you up at a predetermined time.

SILENCE kills the speaker of your PC.

STEPDOS allows you to step through the execution of a program one DOS call at a time, with an informative display at each pause.

VTREE2 shows you a map of your system and the sizes of your subdirectories. Great for pruning.

WATZITDO returns information about the multifarious alternate key combinations on the PC.

WF is a wild card find program that searches for files on your hard drive.

WORLDTIM lets you see the time anywhere in the world.

WPHD disables writing to your hard drive temporarily, protecting it from viruses to some extent.

XPANDISK creates a very sophisticated, variable size RAM disk in expanded memory.

TUNEUP uses your PC's speaker to generate precise pitches for tuning stringed instruments.

FORM generates business forms.

TCAP captures text screens, but makes them into GEM/IMG files suitable for use with Ventura.

$19.95

ALMOST FREE SOFTWARE
VOLUME 39

BOOM is a program to display fireworks on your screen. You probably don't think you need one of these... most likely true, but it's fun to watch. Requires a CGA or EGA card.

COLORDIR is a very slick... and exceedingly fast... sorted directory program which uses screen colours to make large directory listings easier to see at a glance.

DIGCLOCK is a huge screen clock which reads out in seven segment numerals. Easily read from across the room, or across the street with a good telescope.

DISPINFO is a C source file for programmers. It's a routine to allow your code to figure out what video card is in the computer it's running on.

ED is another C source file, this one for the standard unix ed text editor. It has been reworked to compile under Turbo C, and will serve nicely as the basis for a word processor.

EGA2RAM runs the BIOS of your EGA card from fast RAM rather than slow ROM. It speeds up your screen quite noticeably with no snow or other drawbacks. Requires an EGA card, ASM source code included.

FASTGIF is a GIF image file reader. GIF files are glorious colour picture files which must be seen to be really appreciated. We've included a GIF file of a mandrill so you can see what they're up to. Requires an EGA or VGA card.

HP-SLASH reduces the size of LaserJet soft fonts... and their resultant download time... by allowing you to selectively remove unused characters from them. This is an essential tool for anyone using a LaserJet compatible printer.

MAXI.EXE is the answer to every "insufficient disk space" message in creation. It formats up a normal double density floppy to hold four hundred and twenty kilobytes, and a quad density disk to hold almost a megabyte and a half.

PC-POOL is a really well executed pool simulation. The ballistics of the balls is very nearly perfect, and the user interface is well thought out.. Requires a CGA or EGA card.

REMINDER is a memory resident appointment calendar which pops up at the touch of an alternate key. It also features a screen clock which can be enabled or disabled at will.

RN is the best way to move around the subdirectories of a hard drive ever invented. Rather than having to type in complex paths, RN allows you to move around in menu driven comfort.

SAY is the best speech program we've encountered for the PC thus far. It comes with a host of phrases, including the all but essential "beam me up, Scotty". Good for disturbing your stupor in the morning.

VFM will warm the hearts of Ventura Publisher users. It allows you to add and reorganize fonts for this popular desktop publishing system without any sweat, bother or keying of batch files.

MCOPY is command line replacement for the DOS COPY command which allows you to copy files to floppies with maximum space efficiency, a prompt to swap floppies when the disk is full and full CRC checking to make sure that what you see is really what you get. DOS, as it turns out, doesn't verify its copies very well even with the verify flag on. This is an essential utility.

$19.95

ALMOST FREE SOFTWARE
VOLUME 38

CALENDAR is a perpetual calendar running from the middle of the sixteenth century up until way past the age of Star Trek. This program will show you when important dates fall in the years of your choice as well.

CPM2DOS will actually read files from the disks of most CP\M systems onto your PC. Unlike commercial packages which purport to do the same thing, it includes a facility for creating custom formats.

GCAP is the ultimate graphics screen capture. This resident utility wil create GEM/IMG paint files from anything on your tube, suitable for use with Ventura, amongst others... an essential gadget for desktop publishing. Works with EGA monochrome, CGA and Herc cards.

MACSCOOP is an updated version of he popular MacPaint file reader and features support for Epson FX, Hewlett-Packard LaserJet+ and PostScript printers and for EGA, CGA and Hercules display cards. It will let you look at and print any MacPaint image file. We've included a few to get you started.

GEMSCOOP is very much like MacScoop, above, and has the same features for reading and printing GEM/IMG paint files. A really handy tool. for desktop publishing.

MAC2IMG converts MacPaint to GEM/IMG paint files for use with Ventura, among others, allowing you to access megabytes of public domain clip art. Handy for use with IMGCUT, GemScoop and Address also in this collection.

MEMO drives a PostScript device to generate truly eye catching memos. It accepts raw text or WordStar files and prints them sophisticatedly.

FONTS is a collection of our favourite EGA font programs, which will reduce the screen characters of any EGA compatible display adapter. Included are Script, Computer, Future and others. Also included is EGAFONT allowing you to create your own font programs.

ADDRESS is a vastly enhanced resident envelope addressing program which allows for custom printer configurations and either standing text or graphics of your choosing for the return address.

VCHECK will do a CRC check of the sensitive system files on your hard drive each time you boot your machine, ensuring that none of them has been infected with viruses.

IMGCUT extracts fragments of GEM/IMG paint files for use with desktop publishing and other applications which use this image file format. You can pre-crop pictures to save disk space and time and can also make graphics files for ADDRESS, also in this collection.

PINPRESS prints text very small on an Epson FX-80 compatible printer and allows you to cram up to sixteen kilobytes of text in two columns on a single page and keep it readable.

SMALL is the PinPress for laser printers. This thing will print about four standard pages of text on a single sheet of paper... rather small, of course. Works with any PostScript device.

$19.95

ALMOST FREE SOFTWARE
VOLUME 37

386BUG This little program spots 80386 processors with bugs. Includes source code.

MASM-MAC This is a collection of MASM assembler macros to make BIOS, DOS and 8087 interfacing a lot easier. Requires MASM.

8X6 installs a really tiny screen font on an EGA card.

AT is a little time bomb program. It will hide in memory and run applications at specific times.

BACHMIN is a three part Bach minuet in BASIC... quite the trick.

CAT is a small sorted directory program. While hardly high tech, it is a useful replacement for DIR

CAVERNS is a fast graphic arcade game. It looks a bit simplistic but it will surprise you when you get into it. Wants a CGA card.

CMOS is a pair of simple programs which read the contents of an AT's CMOS memory into a disk file and then restore it.

DIRNOTES allows you to attach short, one line comments to the directory entries on your disks.

PRTSCEGA is a program to make the PrtSc function work properly for EGA cards. Versions are included for a stock Epson FX-80 and for the Tandy DMP200. Includes source.

EDISK allows you to put a RAM disk in the space between your normal system memory and your screen buffer, using this otherwise wasted space for something practical. It requires that you have memory in there, of course.

EMC is an extended memory cache. It allows you to use LIM memory for a disk cache, speeding up your disk accesses without robbing your system of any main memory.

GDIR is a sorted directory program which uses the Hercules card's graphics mode to put forty-three lines of listings on the tube at once. It's very slick.

HELP is a slick little DOS help program which can be called up any time you need something about the PC explained to you.

THRASHER is a splendid system to find out the optimum setting for the BUFFERS line in your CONFIG.SYS file.

MCSCOOP is the executable version of the MacPaint file reader in the January 1988 edition of Computing Now!

LDRES is a system to make somewhat standard COM files into memory resident utilities, or TSRs. Please note that while full documentation is included with this thing, it's still a bit technical.

NOREBOOT will disable the Ctrl-Alt-Del reboot of your system. Source code is included.

RES86 is a transliteration of the redoubtable CP/M RESOURCE machine language disassembler. Source code is included. This program requires an understanding of machine level programming.

RS232 will show you the status of your serial port on your screen. It's handy for debugging, and to see what your modem is up to if you have one that lives inside your PC.

WFU is one of the nicest DOS shell managers we've yet encountered.

$19.95 (FORMERLY VOLUME 30)

ALMOST FREE SOFTWARE
VOLUME 36

INSTACALC is a memory resident spreadsheet. It may not be Lotus or Excel, but it's amazingly powerful considering that it lives in an alternate key combination. Includes a sophisticated macro facility.

ALTER allows you to change the attributes of a file... including the time and the date.

CALENDAR is a sophisticated desk calendar which can be made memory resident if you want it to be. It uses data files which allow you to have it remind you of things.

COVER prints disk directories suitable for sticking into the sleeves of your disks... the nicest such program we've encountered. Requires an Epson compatible printer, patchable with DEBUG for other printers.

DISKLITE is a tiny bit of code which shows you when one of your drives is running. Not much use for floppies, this, but great for RAM disks and AT style internal hard drives.

DISKUTIL is a poor man's Norton utility. It will walk you through simple disk level functions, including FAT table fix ups and file unerasure.

MELT clears the screen, dramatically.

MONSTER a memory resident DOS monitor. Check out what your programs do one INT 21 call at a time.

THEGRIN is the most sophisticated MacPaint picture viewer yet. It allows you to stretch and compress images, zoom in and out and generally hack their bits to bits. It also prints them.

TMAP is a clever TSR program mapper which is itself memory resident. It's superb for finding gorches caused by interacting resident programs.

VARISLOW is a variable speed control for AT type computers. It lets you crank the clock down to play games at their normal speeds. However, you can do it interactively, rather than from a command line.

WATERFALL is a fabulous MacPaint picture of an Escher drawing, suitable for use with THEGRIN or any other MacPaint reader.

CHINASEA is a James Clavell novel in a disk file. In this game you get to be a trader in the far east. Try to prosper without getting knifed.

TURBO C PATCHES is a collection of patches to fix some of the bugs in the early releases of Borland's Turbo C. If you're going to compile at warp speed you'd better have one of these.

$19.95 (FORMERLY VOLUME 29)

ALMOST FREE SOFTWARE
VOLUME 35

ASTROLAB A sophisticated program for working out the conjunction of the planets for any day in history. It's not much use if you believe in a flat earth, but handy for horoscopes.

BASERES A resident utility, this thing will accept numbers in any base and show them to you in all the other commonly used notations. In other words, it will convert decimal to hex and back again... great for people with only ten fingers.

BREAKON This is a utility to make just about any program exitable with control-break. It has multiple levels of urgency... three hits gets you out of anything short of the end of civilization as we know it. Assembler source included.

CROSSWRD If you've ever wanted to generate your own crossword puzzles, this is the code for you. Fill it full of words and it finds places for them.

DIMMER The smallest screen blanker yet... two hundred and seventy one bytes.

EPSONISM Even people with laser printers occasionally have to deal with plebes. This program is a DOS filter to make a PostScript printer behave like an Epson.

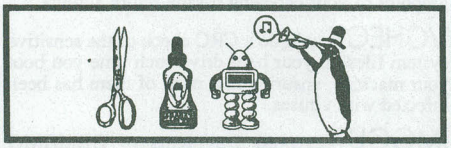
FASTBIOS This is a pair of programs which will extend your keyboard buffer... without hanging your system... and increase the speed of your screen dramatically.

FREERAM tells you the truth about how much useable memory is available to your programs.

LASERGRID This is a rather good ASCII game. Place your bets and hope the aliens leave you alone.

VMUSIC This is a small three voice music player which handles its scores in BASIC music notation. Comes with several songs, and you can easily create your own tunes with a text editor.

IDCKEYS This is an assembly language program to set up the function key redefinitions under ANSI.SYS. It's great if you like to have keyboard macros under DOS without a keyboard redefinition program installed. Requires an assembler to use.



IDCKILL This will go through an entire hard drive... including all your subdirectories... and kill files that match a given specification. A bit nasty if you use it improperly, but great, say, for snuffing BAK files.

LW86 This is an extensive pop up reference card for assembly language programmers. It includes explanations of the op codes, what the assembler directives do and so on, all at the touch of control shift.

SPACE Find out how much useable space is on your hard drive instantly. Includes assembly language source.

YESNO creates complex interactive batch files. This little program returns an error level code basic on the ASCII value of a key press. Assembly source included.

$19.95 (FORMERLY VOLUME 28)

ALMOST FREE SOFTWARE
VOLUME 34

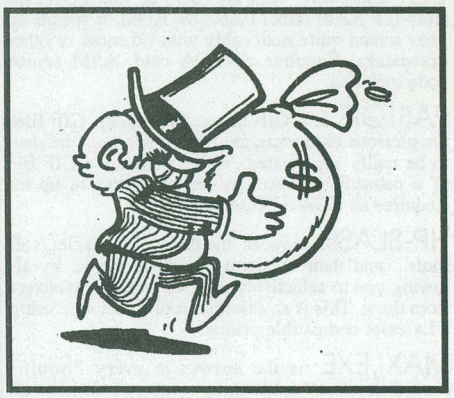
AWS Programs that turn WordStar into ASCII abound, but this one turns ASCII back into WordStar. Let those high bits roll.

BADCLUST This program finds the bad clusters on cheap disks, preventing them from killing your data. If you must use low rent oxide, use it carefully.

CHEAPFMT Like BADCLUST, above, this program makes your life less freaky if you use cheap disks. It formats them very carefully, looking for unusable sectors.

CCC A C language programmer's dream, this is a pretty print program that actually draws nesting loop and structure diagrams beside the source code it lists. It makes spotting even subtle bugs effortless.

CTP Something of a mutated fusion between snake and space invaders, this is a ruthlessly fast arcade game in first rate high resolution graphics. Requires a colour card or HGC, below, and a Herc board.



HGC This is the first colour card simulator for a Hercules board that really seems to have its act together for the majority of colour card graphics software. Run it and your Herc card will display colour card high resolution graphics as if it was designed for the task.

BIGPRINT This program prints text files in very large characters. It requires an Epson compatible printer.

MBS This is one of the nicer fractal programs we've encountered, as well as being one of the faster ones. It runs on a colour card, or on a Herc board with HGC, above.

MOUSE This is the source code for the linkable MOUSE driver, as seen in the July 1987 edition of Computing Now! It requires MASM to assemble and a C compiler to use.

PCRR This is one of the most interesting programs we've yet encountered. It simulates a railroad in high resolution graphics. You can lay out your railroad, equip it with multiple trains and make the whole party go. Requires a colour card or HGC, above and a Hercules board.

TASKER This is the most elaborate multitasking system yet devised for the PC. Install up to nine variable sized partitions, with a program running in each, and pop between them instantly.

WINDOW The source code for the C language window manager from the July 1987 edition of Computing Now! Written in Lattice C.

$19.95 (FORMERLY VOLUME 26)

ALMOST FREE SOFTWARE
VOLUME 33

AC This is a small area code program... give it a three digit area code and it will tell you where it is.

ASC This is a memory resident utility that pops up a window with an ASCII character chart.

ATTR This utility lets you meddle with the attribute bit of your files.

BAC This is a disk backup utility that is much less frightening than the one that comes with DOS.

BACKSCRL This recalls stuff that has scrolled of your screen. It's neat if you can't seem to reach the NumLock key in time.

CAT This is a collection of disk utilities in one program.

CLOCK One of the nicest clocks we've seen, this has a built in alarm function among other things.

COVER This is a sorted disk directory that prints out all the files on a floppy in a form suitable for sticking to the sleeve.

CWEEP This is a menu driven file mover... saves typing the word COPY over and over again.

DDIR Yet another directory utility, this does a two column directory similar to the regular single column DOS version.

DELZ This wipes out files so they can never come back... kills the sectors as well as the directory entry.

DISKCAN This one checks your disks for bad sectors... get 'em before they get you.

DOORS This lets you flip between multiple monitors without rebooting your system.

EQUIP This program tells you what hardware your system thinks it has... often providing you with the answer to many software problems.

FASTDISK If your floppies seem a bit tedious, you might want to zap 'em with this speed up program.

FDATE This changes the date stamps of files.

FLIP sets a number of otherwise tedious parameters under DOS.

FREE This returns the amount of free space on a disk without having to watch the whole directory scroll by.

GERM This is a memory resident interrupt driven communications terminal.

IBMSHELL This allows you to fool your system into loading COMMAND.COM from other places.

KBBUFF This is a keyboard buffer extender. No home should be without one.

KEYFAKE This allows you to stuff keyboard characters into an application to get past tedious introductory screens and menus.

LC This counts the number of lines in a text file.

LOCATE This scans through subdirectories, checking all the files for specific text strings.

LOCK This is a file encryptor. Also includes UNLOCK.

MOVE This moves files between subdirectories with less typing than COPY would entail.

NDOSEDIT An updated version of regular DOSEDIT, this is a resident DOS command line editor that actually makes DOS decent to work with. Indispensable.

NO This is a strange little wild card exception thing. It allows you to create more complex file specifications than does DOS all by itself.

NPAD This is a simple memory resident note pad.

PCUTIL This is a collection of add ons to DOS.

PINHEAD The printing press program from the June 1987 edition of Computing Now! It can get up to 16 kilobytes of text on one page. Includes the C source code.... works with Epson compatible printers.

POPCAL This is a memory resident utility which will bring up any month of any year you like.

PR This is a handy formatted printing utility.

PUSHDIR allows you to change subdirectories, do something, then return to the previous directory.

REBEEP A replacement for PAUSE, this is a noisy batch file utility to attract attention when a task has been completed.

RENDIR renames subdirectories.

SCRN blanks all the monitors attached to your system after a specified period of inactivity to keep your phosphor from getting fried.

SETPRN This allows you to painlessly set up your printer from DOS.

SETUP This is a memory resident utility that will allow you to set up an Epson compatible printer from within any application.

SIZE This returns the number of allocation clusters a file occupies on the disk.

SOUND makes noises to attract attention from within a batch file.

SP A nice little print spooler.

SWEEP This allows you to execute a command in every subdirectory on your disk.

UNDEL This recovers accidentally deleted files. You may not need it now but you sure will sooner or later.

VDL This requests verification before it deletes files so you won't need UNDEL quite as often.

VOLSER Changes the volume name of a disk.

WAITN This pauses for a specified time while executing a batch file.

WHEREIS This finds files in subdirectories. It includes the C source code from the June 1987 edition of Computing Now!

XDEL This is a menu-driven file deletion utility.

$19.95 (FORMERLY VOLUME 24)

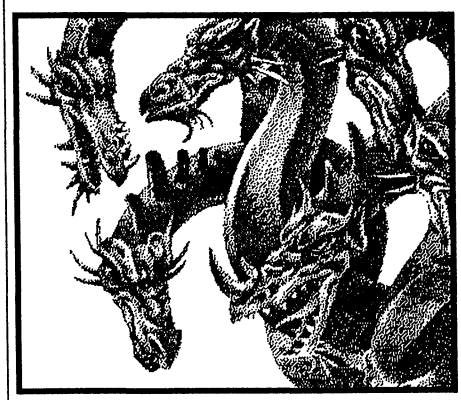
ALMOST FREE SOFTWARE
VOLUME 32

ARCE A really tiny archive utility, this thing will extract members from ARC files without tying up half a disk for itself.

BABY An extremely warped game, this thing is engaging and fairly challenging none the less. It involves catching babies who are leaping out of a burning building.

CHMOD This is a useful utility for reading and changing the bits in a DOS mode flag.

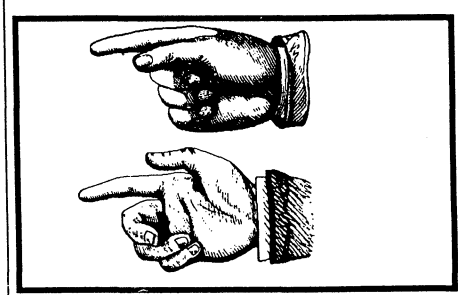
CITYDESK This is an elegant fancy printing program that allows you to do some desktop publishing functions with a dot matrix printer.



DOG A disk organizer, Dog will defragment the files on your disks to make them quicker to access.

FPR This is a printing program written in C. It's not compiled... you can change it to meet your needs. Requires a C compiler.

THRILL There is little to say about this program. It's a beautiful example of high resolution PC graphics, and was too good to ignore, even if it was wholly useless. It's also a bit naughty.



MIDI-IO The source file for the interrupt driven MIDI communication module from the April 1987 edition of Computing Now! Requires MASM to assemble and a language compiler to use... preferably C.

PC-WRITE The latest version of this phenomenal word processor, this thing is enough to turn you off any other word processing package on the planet.

EDWIN This is a decent windowing program editor written in Turbo Pascal. It's not terribly fancy, but it's fast and very much like WordStar.

$24.95 (FORMERLY VOLUME 23)

ALMOST FREE SOFTWARE
VOLUME 31

BOTH is a small utility which can slash your paper bill by allowing you to print long files on both sides of the paper.

DIAGS Written by the author of Z80MU, this collection of tools will be nirvana for the experienced PC programmer. It does things like generate an annotated list of all the interrupt vectors in your PC, let you meddle with the 6845 registers, test most of the ins and outs of your system and so on. It's a brilliant bit of work.

GRCP Graphic cut and paste is a memory resident tool that allows you to scoop things from a PC high resolution graphic screen and pop them into other applications.

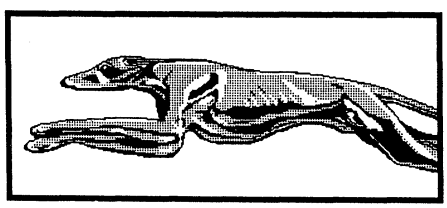
LOCKERUP This tiny microbe of code sleeps in your system until you have to leave your PC for a while. Then it enables you to lock up your keyboard until you come back to restart it. It's perfect for offices where there are more fingers than hands to contain them.

MEGAPEDE Just when you thought that it was safe to play ASCII games again... This one is a sophisticated variation of the classic snake programs and it plays with the speed of a cobra on acid. Don't count on winning for a while.

MURPHY Sort of an iconoclast in a can, this program will print a random selection of several hundred of Murphy's laws, corollaries and commentaries thereon each time it's run. If you put it in your AUTOEXEC file it will say something clever each time you start your computer.

QUEBERT This fast PC implementation of the classic arcade game is every bit as exciting as the real thing but lacks a coin slot. Jump down the mountain, avoid the snake and try not to get clobbered with fresh fruit.

SAT This is a powerful, menu driven satellite data downlink terminal, as discussed in the December 1986 edition of Computing Now!.



SCAV This is a great program for people who buy economical floppy disks and just about everyone else who can't afford a clean room for their PCs. It cruises through one's disks locking out bad sectors and restores previously 'fried' disks to usefulness.

SimCGA The utility does an astoundingly good job of making a Hercules graphics card behave like a colour graphics adapter. It will let you run most CGA software.

STUFFIT Stuffit is a disk management utility which stuffs files into the inner tracks of a floppy disk, allowing the outer tracks to be used for work space. This improves the disk access times and the reliability of mostly full disks considerably.

$19.95 (FORMERLY VOLUME 19)

ALMOST FREE SOFTWARE
VOLUME 30

ALTAMIRA This is one of the nicest public domain paint box programs available for the PC. It does first rate pictures. Colour graphics card required.

FRACTAL This is the C source code for the fractal generator that first appeared in the August 1986 issue of Computing Now! Requires a C compiler and a colour graphics card.

NEMON This is a really weird game. You get stuck in the catacombs of king Nemon with nothing more than your wits and a flashlight. You have to find some keys, some treasures and, hopefully, a way around a host of arcade game nasties.

THOR used to be the god of thunder. Now he appears to be the world's most sophisticated desk calendar program for keeping track of appointments.

ROUND 42 This is bizarre variation on the theme of space invaders. One of the best computer games in creation. Requires a colour graphics card.

V20 is a CP/M emulator for users of the NEC V20 chip. Replace your existing 8088 with a V20, score this little program and most CP/M software will run on your system as if someone had stolen half the bits out of your PC. Regular MS-DOS isn't affected. Requires a V20 chip.

$19.95 (FORMERLY VOLUME 15)

ALMOST FREE SOFTWARE
VOLUME 29

MONOPOLY is a good implementation of the classic board game. Great graphics and sound.

D20 is the latest version of Steve's sorted directory program. This one uses DOS two calls and handles subdirectories.

EDIT is a lightning fast full screen editor, ideal for editing program source files, dBASE stuff or other ASCII phenomena.

BANNER takes mere text and prints it sideways on your printer... in gargantuan block letters that can be read from miles away if you have a good set of binoculars.

MORTGAGE is one of the nicest mortgage programs we've seen so far... lifelong debt and ruination has never been so well formatted.

QUICK speeds up your PC quite a bit by improving video response.

SPEECH is a rather remarkable little germ of code. It talks through the PC's internal squeaker speaker. The voice isn't exactly human, but it's understandable on most machines.

PC-AR is an accounts receivable package for the PC. It will take care of the records for a small or medium sized business quite well.

$19.95 (FORMERLY VOLUME 10)

DISK OF THE MONTH CLUB

If you enjoy Almost Free Software but never seem to get around to ordering it, we'd like to introduce you to our disk of the month club.

The disk of the month club provides you with a convenient way to get the best of public domain software and shareware, all without having to order it. Members of the club are sent each new disk automatically, roughly one disk every four weeks. Each disk is billed to a pre-authorized credit card number.

If you join the disk of the month club, you'll be able to review each new software collection at your convenience. If you receive a disk you don't want to keep, simply return it for immediate credit to your account.

For a limited time, if you sign up for our disk of the month club, we'll send you a bonus disk with your first order. Simply select any disk from this catalog and we'll include it free with your first monthly disk.

To sign up for the disk of the month club, please write, phone or FAX us. Have your Visa, MasterCard or American Express card handy.

Yes, I want to be part of the Almost Free Software disk of the month club. I hereby authorize Moorshead Publications to charge the credit card detailed below for each new disk as published. I understand that there will be approximately one disk per month and that I will be charged the advertised price, not to exceed $25.00.

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Moorshead Publications, 1300 Don Mills Road, Toronto, Ontario M3B 3M8 (416) 445-5600 FAX (416) 445-8149

WINDOWS TOOLBOX VOLUME 1

Windows is one of the few truly universal user interfaces. It's equally approachable by new users and experienced professionals, and it makes any application written for it a nicer place to be.

In this collection we've assembled an assortment of public domain Windows applications. Some are just unique little gadgets, others powerful programs to make your Windows environment more productive. All of them, though, represent the power and functionality of Windows.

This collection is only available on quad density disks. Please note that this disk requires Microsoft Windows to run. Windows itself is not included.

FIREWORKS is a screen blanker which will save your monitor by fading to black after a preset time of inactivity. While it's sleeping, it displays random pyrotechnics.

GLOBE shows you the world... rotating, at various magnifications and going in any direction you please.

FISHES is a aquarium in a window. Everyone ought to have one of these.

FREEMEM puts up a window which tells you how much free memory you have available.

DIGCLOCK puts up a tiny window which tells you the time. This is not as sophisticated as the analog clock window, but it takes up a whole lot less space.

SNAP copies parts of your screen to the clip board.

HEXCALC is a hexadecimal calculator.

FUSE is just an attractive window to fill an otherwise unused corner of your screen.

COMMAND POST adds features to Windows, making it a lot easier to use.

CMDTREE runs with Command Post to make changing directories dead easy.

TETRIS is the classic Soviet falling block puzzle done for Windows.

PUZZLE is a puzzle game with a twist. Assemble the scrambled faces. Comes with an assortment of faces to choose from.

BOUNCE is a really slick bouncing planet window. It's a hoot to watch.

CREDIT is a Windows credit card manager. If you live by plastic, this program will keep you from dying by it too.

DESKTOP is another Windows command shell, this one with a configurable user interface. It was a hard choice between this program and Command Post, so we've included them both.

GCP is a graphics tool for Windows. It allows you to look at and manipulate most of the popular paint file formats, including GIF and PCX.

UNICOM is a nicely executed telecommunications program for Windows.

HPCALC is a Hewlett-Packard style programmable scientific calculator in a window.

TIFFANY will copy the contents of any window to a TIFF file.

FINDER will locate files across any combination of drives you specify.

$19.95

HARD DISK SURVIVAL KIT

If you have a hard drive you can have all sorts of powerful utilities and programs installed in your system to make use of it more efficiently. We've collected the best of these utilities on a single disk to help new PC users get the most from their hard drive systems. Please note that some of these programs are included in our other almost free software disks. Descriptions of them are provided elsewhere in this catalog.

HGC Colour card emulator for Hercules

ADDRESS Resident envelope addresser

WHEREIS Hard drive file finder

SIZE File size finder

SETUP Resident Epson printer setup

RENDIR Subdirectory renamer

POPCAL Resident perpetual calendar

CLOCK Screen clock

EDWIN WordStar like editor

NANSI Screen driver

CACHE Disk cache

RAMDISK RAM disk program

LPTX Printer redirection

MURPHY Foolishness and wisdom

LOCKERUP Security system

BOTH Printer paper saver

PCWINDOW Resident grab bag

PINPRESS Prints things very small

NOTEPAD Resident notepad

FREE Free space finder

HOTDOS Multiple tasker

BLANK Screen blanker

K9 Another resident grab bag

LAZY Menu generator

UNWS WordStar converter

MORTGAGE Measure of your indenture

LOOK File viewer

PCBW Colour killer

VTREE Hard disk map

VFILER File manager

POPCALC Resident calculator

DOSEDIT Command line editor

$19.95

ALMOST FREE AUTOCAD VOLUME 1

This collection is a series of enhancements for users of the popular AutoCAD drafting package. These have been custom written by our in-house AutoCAD guru. Requires AutoCAD release 9.

PULL-DOWN MENU with over one hundred and fifty of the most often used commands, values and related variables grouped in logical order — almost eliminates searches and menu trees. Includes custom macros that call up a series of commands with a single pick.

CUSTOM ICON MENUS let you see your symbol library drawings or hatch patterns before you choose.

CUSTOM SCREEN MENU for rapid picking among your favorite commands or macros.

COMMAND TABLET MENU for rapid picking of commands and macros (requires digitizing tablet), plus a blank DWG and menu file for making your own. Includes 175 custom commands

ELECTRONIC SYMBOLS complete with icon menus for no-typing selection. Includes common analog and digital symbols for all types of schematic drawing.

PLUS: All the menus are ASCII files and can be easily changed with your word processor. Edit the commands just the way you want them, for your style of drawing.

PLUS: complete documentation files with explanations of all the menu structures and macros and how you can change them.

$19.95

IN A HURRY?

If you'd like to receive your software sooner, we can probably help.

To begin with, you can order by phone any day of the week during business hours. Simply have your Visa, MasterCard or American Express card handy.

If it's more convenient, you can order by FAX. Simply fill out the order form at the end of this catalog, including your credit card information. Drop it in your FAX machine and we'll have your software on its way to you before you know it.

PHONE: (416) 445-5600
FAX: (416) 445-8149

Computer games are what makes suffering through dBASE, Lotus and Word Perfect really worth it. We've assembled some of the best public domain PC based games in the following collections. Buy one of these disks and you'll get no useful work done for at least a week.

ALMOST FREE GAMES VOLUME 4

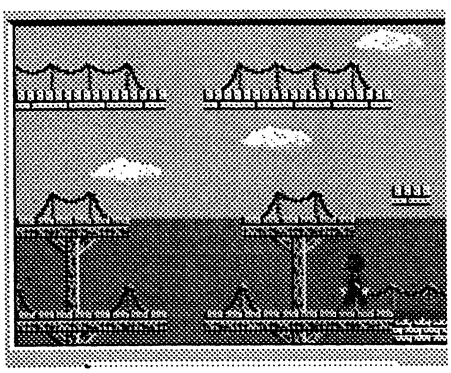
SUSAN is a straight text adventure style game. The object of the game is to talk Susan into bed. Not exactly reluctant, Susan is not an easy date, either. This game contains adult situations, and should not be played by ruggies... who won't understand it anyway. If you plan to give this collection to the kids, we recommend that you delete this game.

PODWARS is a fast ASCII graphics game in which you get to cruise around levels of a space ship picking up things and killing other life forms. All that quest and slaughter is a lot of fun. Playable on any machine.

STAR GOOSE is a brilliantly conceived, gloriously executed graphics arcade came. It lets you fly a space ship over very weird alien terrain, blowing things up, flying into the jaws of death... literally... and picking up giant floating eyeballs. If the explanation is already leaving you behind, you really should play Star Goose and find out what it's all about. Requires an EGA or VGA card.

QUAD ALIENS is the strangest thing ever to infest a computer, and the mind which devised it was obviously pretty warped. The plot is all but indescribable... you get to wander around rooms that look like Luke Skywalker's worst nightmare, pushing things out of the way while you try to keep a reactor from going critical and blowing you to kingdom come. Even if you never work your way through it all... which is quite possible considering its complexity... Quad Aliens is worth it just to watch all the action. Requires a VGA card.

$19.95



ALMOST FREE GAMES VOLUME 3

CAPTAIN COMIC is the best video game ever written for the PC, commercial or otherwise. Reminiscent of the Dark Castle graphic adventures for the Macintosh, it lets you guide your purple faced hero through a complex graphic world, picking up things, blasting monsters and ultimately finding the... well, we won't tell you what he finds. Requires an EGA or VGA card.

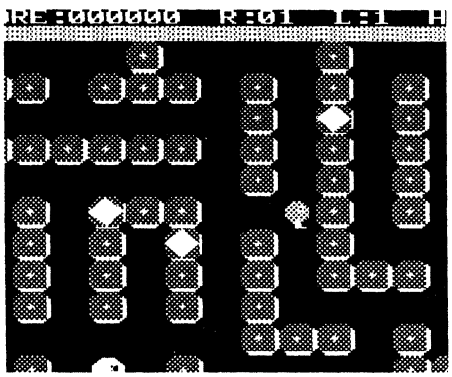
3-DEMON is three dimensional PacMan. Wander through corridors picking up food pellets and avoiding ghosts. Requires a CGA, EGA or VGA card.

QIX is an ASCII version of the arcade game. It's fast and runs on any card.

RACECAR is a brilliant ASCII game that lets you drive through a writhing, debris strewn course of death and disaster.

SEAHUNT is a computerized battleship game. It involves strategy, skill and a grasp of military tactics. You also have to like sinking ships.

$19.95



ALMOST FREE GAMES VOLUME 2

BRICKS is a classic implementation of "Little Brick Out", a game which dates back to the earliest personal computers. Kill bricks and relive a bit of history.

FLEES is a lightning fast, arcade quality alien slaughter game... get the space fleas a'for they get you. Slaughter and green blood abound. Requires an EGA card.

PANGO is a rather strange little arcade game. You wander around kicking the hell out of bricks and squashing bees. It's fast and peculiar.

PIRATE is a huge graphic adventure game in which you wander through tunnels searching for buried treasure. The pictures are good, the plot is clever and gory, violent death awaits you. Fun for the whole family if they're a bit blood thirsty.

PITFALL pits you against the most dreaded space enemy of all... gravity. Pilot your ship down through the pit without getting mashed on the rocks.

RIBIT2 is the best public domain implementation of frogger we've encountered for a PC. Get your frog across the highway without having it run over.

ROUND42 is a peculiar little effort along the lines of space invaders. However, it's fast and evil, and will take you a long time to get the better of it.

STRIKER puts you in command of an attack 'copter flying into enemy territory. It's all done with pretty slick graphics, from the chopper itself to the missiles which will blow you into the next game room. Just like an arcade but it doesn't need quarters.

SUBCHASE is a graphic war game. You sail along dropping depth charges on unsuspecting subs. They frown on this sort of thing now, but it was very trendy in the early forties.

$19.95

ALMOST FREE GAMES VOLUME 1

CARD is a simple draw poker game. You can shoot it if it cheats without having to worry about its cousins coming after you.

CASTLE remains one of the most engrossing public domain computer games. Wander around a nearly deserted castle collecting things and trying to get out.

CHESSII is a sophisticated chess game in which you can actually pick up and move the pieces. Features multiple look ahead levels. Requires a CGA, EGA or VGA card.

EGAROIDS is a stunning EGA asteroids game for EGA and VGA cards. Kill the rocks or suck vacuum.

FROGGER is a PC version of the classic arcade game. Get your frog across the road without making him into frog puree. Requires a CGA or EGA card.

HAUNT is a text based adventure game in which you can work your way through a haunted house with an endless array of rooms and objects.

LINKFOUR is a computerized version of the popular Connect Four vertical checkers game. Requires a CGA or EGA card.

PACKGAL is an ASCII based version of Pac-Man. Eat the punctuation and avoid the spectral characters.

PINBALL2 simulates a pinball game. This one has all the traditional flippers, out lanes, kickers and so on. Requires a CGA or EGA card.

TREK lets you tear through space meeting new and exciting life forms and slaughter them. It has lots of action and even a plot of sorts. Requires a CGA or EGA card.

WILLY is the strange saga of Willy the worm. In this episode you get to help Willy go home. Requires a CGA or EGA card.

$19.95

VENTURA
SURVIVAL DISK

If you use the popular Ventura desktop publishing package, you'll probably be aware of a few of its... ahem... deficiencies. For example, you may have encountered the monumental difficulties involved in using it with additional soft fonts. Perhaps you've tried to pour image files into your documents and found them a bit awkward. What about the unspeakable boredom of having to use the same type faces over and over again... it's driven lesser mortals back to their typewriters.

As long time Ventura users ourselves, we've developed and collected quite an assortment of Ventura support programs. These things perform all sorts of useful functions, mostly connected with making Ventura a better place to live. Much of the software in this collection is specifically intended to make Ventura co- exist peacefully with a LaserJet compatible printer. If you publish with Ventura, you can't afford to be without this collection of programs.

FONTFILT is a splendid program for making boring fonts into exciting ones. It inhales any standard LaserJet soft font and outputs a font with your choice of special effects added to it, including drop shadows, bounding boxes and even dripping blood.

VFM manages your Ventura soft fonts. It quickly makes width tables without any batch files to contend with, allowing you to add fonts to Ventura painlessly. This is a must for any Ventura user.

GRAPHIC WORKSHOP is the last word in graphics programs. It views, converts, dithers, halftones and prints all popular image files. It works with MacPaint, GEM/Ventura IMG, PC Paintbrush PCX, GIF, TIFF and EPS files and drives CGA, Hercules, EGA, VGA, ATI VGA Wonder and Paradise cards. It's an indispensible tool for graphics in desktop publishing.

HP-SLASH will reduce the often times voluminous sizes of soft font files by allowing you to selectively "prune" out unused characters and symbols. Saves on hard drive space and really speeds up font downloading.

TCAP is a memory resident program which captures text screens as GEM/IMG graphics suitable for pouring into Ventura documents as pictures. These screens preserve the original screen attributes and can be scaled to any size from within Ventura.

GCAP captures monochrome graphics screens into GEM/IMG files, suitable for pouring into Ventura chapters. A Windows compatible version is also included.

FSEE is a quick 'n nasty program to let you view the contents of a soft font file on your screen before you print it. It lets you see what the new fonts will look like without your having to download them and print them out.

VPSCREEN is a Ventura screen font editor. It allows you to change the way fonts look on your screen.

$19.95

ALMOST FREE
LASERJET FONTS

There hasn't been a Ventura user yet born who hasn't cried out for more fonts. These collections should silence even the most obstreperous of them. We've assembled the strangest fonts we could find... add these typefaces to your desktop publishing chapters and no one will miss them.

Included in each of these collections are complete instructions for installing them in Ventura Publisher. These fonts are suitable only for use with LaserJet compatible laser printers.

LASERJET FONTS 1

Amityville 18 Point
Avantis 18 Point
Basque 18 Point
Begotten 18 Point
Big City 18 Point
Centurion Medium 18 Point
Channel 18 Point
Channel 24 Point Oblique
Copper 18 Point
Courier 18 Point
GalaxyGlue 18 Point
Garnet 18 Point
Abbode 18 Point
Gillie 18 Point
Olivia 18 Point
Ornation
Optimial 18 Point
Palatinus
⊥ • φ r ∩ ∞ ⊥ ∩ θ ∈ ∫ (symbol)
Prestigus
Hoboken
Sebastian
Rocky
Olde Englishe
Script
Cartoon
Channel 12 Point

$19.95

LASERJET FONTS 2

Buck 24
Bongo 24 Bongo36
Chancellor Italic 10 12 14
Chancellor Bold 18 24
Chancellor Bold Bloody Italic
Chancellor Bold 30 40
Chancellor 50
Cellestial 18 Cellestial Bold 12
Cellestial Italic 10 Cellestial 8 10 12
Avant Reversed 22 Opus 28
Handwriting 16 tempus 12
Windsor 24
Bold 10
Prolog Italic 10 Prolog 10 Prolog 7
Deco Plus 12 Deco Plus 14
IMPRESSED 12
Times Mutant Italic 12 Bold Italic 12
Times Repressed Bold 18
RUNIC 12 *Coronet 18*
Gaspipe 36
Roadblock
WOOD FENCE

$19.95 QUAD ($31.95 DUAL DENSITY)

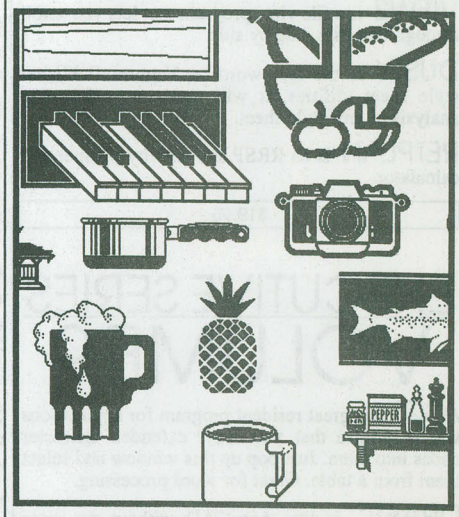
SLOTH
Z80 DESIGN SYSTEM

If you've ever wanted to learn about the real technology of computer design, here's your chance. Alternately, if you need a small, dedicated microprocessor system for custom controller applications, this is the slab of fiberglass you've been waiting for.

The Sloth is a dedicated microcomputer designed for custom applications. It features a Z80 processor, two kilobytes of static memory, two kilobytes of ROM, a three channel programmable timer and twenty-four lines of I/O. It drives a six digit LED display and a speaker, but you can add all sorts of other peripherals to it.

Your imagination is the only limit to what you can do with a Sloth board.

You can't run Arkanoid on a Sloth, but you can learn to develop dedicated microprocessor firmware on one. With it, you can enter the exciting world of microcontroller design and programming. The Sloth will help you learn how to create real world microprocessor hardware applications.



If you're already familiar with Z80 machine language programming, the Sloth is a great platform for creating your own dedicated control applications.

The Sloth package includes a bare Sloth board, a bare LED display board, a complete parts list, stuffing instructions and extensive documentation to get you started writing programs to run on it. This kit does not include the parts required to build up the Sloth, but we've designed the board to use easily available components.

In order to develop programs for the Sloth, you'll need a basic knowledge of Z80 programming and a system to assemble Z80 code and burn it into 2716 EPROMS. We're able to offer several approaches to this, including our Z80XASM package on Almost Free Software volume 43, allowing you to create object code for the Sloth on a PC.

$37.95

Executive Series software has been designed with business users in mind. These disks contain no games, no programming utilities and no recreational software. They're stuffed to the last byte with productivity software, programs which will make your computer work harder and do more for you. If you use a PC and want to get the most out of it, you owe it to yourself to try Executive Series Software.

EXECUTIVE SERIES VOLUME 10

PC-AREA is the last word in telephone area code programs. Hit the alternate key of your choice and it pops up a window with all the provinces and states in North Americar.

FREEFORM is a data base manager for people who *don't* want to mess with dBASE. It creates a data base which is easy to use, requires no set up and can be keyed by a trained chimp.

STACK is a DOSEDIT replacement. It keeps a stack of your previous command lines.

CREDIT is a credit card manager, suitable for use in business or to keep track of your personal finances. It helps you refrain from spending yourself into oblivion. Requires Microsoft Windows.

VIEW2 is a file view program that lets you scroll through two files side by side.

DUSTY is the last word in Ventura Publisher style sheet utilities. It will create an exhaustive analysis of any style sheet.

RETPLAN is an RRSP and annuity planner and calculator.

$19.95

EXECUTIVE SERIES VOLUME 9

ASCI is a great resident program for applications which require that you enter extended character codes into them. Just pop up this window and select them from a table. Great for word processing.

DRAFTC is like AutoCAD without the price tag. Requires a mouse.

TRICAL is the most sophisticated pop up calculator program yet devised.

CLIP allows you to extract sections of GIF files and make them into new, smaller GIF files.

FREEMEM is a dandy little Windows program which puts a window on your screen to tell you the current amount of free memory available to your applications. Requires Windows.

SUBMIT is an instant batch file. It allows you to run multiple commands at one time from the DOS prompt by separating them with colons.

TIME puts a digital clock into a Windows screen.Requires Windows.

TODDY is a DOSEDIT replacement. It adds a sophisticated command line editor to DOS to allow you to recall and edit previous commands. Saves buckets of typing and uses WordStar editing commands.

$19.95

EXECUTIVE SERIES VOLUME 8

ASEASY is the latest version of theLotus work-alike spreadsheet package. Featuring no copy protection, macros, pull down menus and more, it's the slickest piece of business shareware.

BAK will visit every subdirectory on your hard drive and automatically kill off all your BAK files.

BOOKMAKE uses an Epson compatible printer to format text so it looks like book pages..

IBM_SCRN is a downloadable character set for an Epson compatible printer which features all the high order graphics characters which you see on your screen.

JOT-IT is the slickest, most sophisticated resident note pad program yet written.

NOYB stands for "none of your business". It allows you to blank your screen whenever you leave the room. Once blanked, only you can restore it.

PCDC is a complete and extremely powerful database manager for handling flat file databases.

POSTGIF is the most recent version of our popular desktop publishing utility. It converts GIF files into high quality halftoned clip art for use with Ventura, PageMaker, etc.

QCRT speeds up the screen updating for most systems quite noticeably.

SPEED also speeds up the screen of your system. This one has been fine tuned for EGA cards, however. Requires an EGA or VGA card.

SS is a spelling checker very similar in operation to the Webster's New World Spelling Checker.

THESAURUS helps you find better words to write with. Given any word, it will suggest other words which mean the same thing.

$24.95 (TWO DISK SET)

EXECUTIVE SERIES VOLUME 7

DECEIVE is designed to save your job in the event that someone in authority pops in unexpectedly. Allows you to copy any screen from a business-like application and instantly pop it up over your video game, resume or other incriminating effort.

INVOICER is a complete inventory management, accounts receivable and invoice generator package.

LM is the hottest label maker and mailing list management package we've encountered.

KDCG is an elegant calculator program. Runs from the DOS prompt and provides a calculator that's as close to a real one as you can get. Requires an EGA or VGA card.

PHONES maintains a list of telephone numbers for you. If you have a modem, it can even dial them for you. Requires Microsoft Windows.

POPDBF is ideal for anyone who uses dBASE, Foxbase or any dBASE compatible packages. It's a pop up window which allows you to browse through any DBF file from within any application.

MINDREADER is a word processor for people who can't type. As you type, it uses artificial intelligence to guess what you'll type next.

ONEKEY is an elegantly simple keyboard macro program.

$24.95 (TWO DISK SET)

EXECUTIVE SERIES VOLUME 6

INSTANT NETWORK Using a simple serial cable, this package will network any two PC's together.

LASER FONT EDITOR is a LaserJet laser printer soft font editor. Requires a Microsoft compatible mouse.

BS We won't tell you what "BS" stands for in this case, because we're sure you can work it out for yourself. Creates very meaningful sounding but very meaningless text.

FILE FINDER Faster and more flexible than Norton's FF utility, this program will find any file or group of files on your hard drive.

EGA RULER is for anyone who uses an EGA or VGA card. It will pop a text ruler over your work to help you line up spreadsheet columns, adjust your letters to fit your letterhead and so on.

WINDOWS FINDER is a Microsoft Windows application. Will locate files anywhere on your hard drive.

INTEREST CALCULATOR is a great little loan calculator. Given the principal, interest rate and payment size of a loan, it will print up a table to tell you how long your indenture is going to last.

INVENTORY should be on every computer on the planet. It helps you keep track of the contents of your home or office, providing you with a running count of the replacement cost of your assets.

JDOS allows you to pop a DOS command line up from within most any application... even if your application doesn't have a DOS SHELL facility. Will give you a full house of memory to run programs in, not just what's left over by your first program.

NOTE is a browse program which runs as a pop up utility. Allows you to read any text file from within another application and it only ties up a few kilobytes when it's hiding in the background.

$19.95

EXECUTIVE SERIES VOLUME 5

DERASE is the best file un-erase program we've encountered. It recovers most accidentally deleted files.

LETTERS 'N LABELS is a mailing list manager for moderate size mailing lists.

LASTRESORT gets you back to DOS, and usually allows you to save your files, when your computer hangs.

800K allows you to format normal dual density 360K floppies to hold eight hundred kilobytes in the high density drive of an AT.

WMF manages a portfolio of mutual funds... diligently. Allows you to edit and update your portfolio, print reports and even see detailed graphs.

MONEY WATCH is an elegantly simple money management program which is equally useful at home, for small businesses and for handling the finances of individual departments of larger businesses.

$19.95

EXECUTIVE SERIES VOLUME 4

CALCQF Speed up your computer... possibly by several hundred percent... with no tricky hardware changes. Calculates how much of a speed increase you can realize and then sets up your machine to do it.

CONFMT allows you to format disks in the background while you're performing another task.

FM is a menu driven file manager. Copy, move, delete and generally meddle with your disk files, without typing commands.

FORMATQM formats lots of floppies very, very quickly, and is a worthwhile companion to CONFMT, above.

FINANCIAL PARTNER provides you with a variety of handy financial planning tools. Work out loans, annuities and other money matters with blinding ease.

HERCSAVE is for anyone using a Hercules compatible graphics card, blanks your screen after a set period of inactivity to avoid burning out your screen.

INSTACALC is a spreadsheet in a can. It's memory resident, and you can pop up a full blown spreadsheet program, complete with macros and all the trimmings, from within any application.

JETLAG helps you calculate how long you should be prepared to take it easy after a long international airplane journey.

MEMO will print memos with the word "MEMO" at the top in special effect characters. Requires a PostScript printer.

MURPHY helps keep your sanity by printing, from the AUTOEXEC file, a different clever thought every morning.

PINPRESS prints up to sixteen kilobytes of text on a page. Great for making archive copies of large documents. Requires an Epson FX-80 compatible printer.

POPDOS2 is a pop up utility which will handle your files and directories effortlessly from within any application.

QUIKCOPY is a replacement for the DOS DISKCOPY command. It duplicates disks in half the time or less, and makes multiple copies even quicker.

TED is the worlds smallest text editor. Use it for creating batch files, quick notes to yourself and other instant files.

ZAPDIR kills off subdirectories with one command... even if there's still something in 'em. Saves on manual deleting.

UNWS is a quick 'n nasty filter to turn WordStar files into text.

$19.95

EXECUTIVE SERIES VOLUME 3

CLEARCUT will make your writing more readable by helping you to spot excessively large or difficult words.

CALLFOR is the pop up equivalent ofpink message slips that litter most offices.

SHFTPICK allows you to skip over the loading of resident programs when your computer boots up.

SMOOTH is a text "browsing" program. Lets you read documents by scrolling. EGA or VGA card required.

VALET is a DOS shell allowing you to use simple menus rather than complex typed commands to handle moving files, changing directories and so on.

WIPE will obliterate every trace of a file. Essential for sensitive data.

YEARCAL prints up a calendar for any month of any year in the twentieth century... in sixteen languages.

ASEASY is a powerful spreadsheet package, in many ways the equal of Lotus. Small, fast and *not* copy protected.

BANNER prints up any phrase you like as a huge banner lengthwise along a strip of printer paper.

CALENDAR is a desk calendar and daily planner with lots of options. Much harder to misplace than the paper kind.

COVER prints the directory of a floppy disk so that it slips into the disk sleeve as a reminder of what'son the disk.

DISKLITE is for people with machines that have internal hard drives and hard-cards. A flag in the corner of the screen tells you when the drive is running

PALERT warns you when you're running out of disk space, saving you from a computer full of work and no way to save it.

BOTH lets you print long text files on both sides of the paper.

LOCKERUP lets you lock your keyboard instantly when you're not there, protecting it from unauthorized access.

$19.95

EXECUTIVE SERIES VOLUME 2

BCOPY is a replacement for the DOS COPY command which copies files as a background task. As soon as you let it go, it returns you to the DOS prompt so you can get back to what you were doing.

BELL makes the beep in your PC sound like an electronic phone.

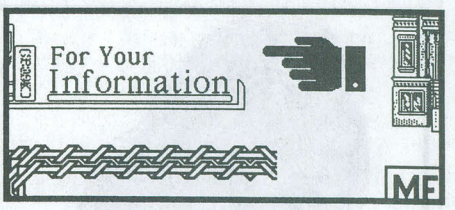
NJFRERAM tells you how much free memory is left in your machine from minute to minute, even when you're inside an application.

CASE will convert text into all lower case, all upper case, capitalized words and it'll even clean up WordStar files.

MAXI is a disk formatting program which will allow you to get four hundred kilobytes on a regular 360K disk, or almost a megabyte and a half on a quad density disk.

POPCALC is a handy four banger calculator which pops up in a window whenever you need it.

TONTO is a sort of SideKick clone which provides a number of useful functions in a window when you call it forth.



VFILER is a file manager which will help you move, copy, rename and delete lots of files without lots of typing.

WHEREIS locates files on your hard drive... no matter where they're lurking.

MCOPY is a DOS COPY replacement with lots of features. Copies files over multiple floppies if you have too many to copy onto one. It uses a sophisticated algorithm to ensure you use your floppy space efficiently. It's a replacement for BACKUP and RESTORE in this case. Also does CRCchecks toensure your important data isn't corrupted.

ADDRESS is a resident envelope addresser which works with most popular word processors. Allows you to roll an envelope into your printer and have it addressed automatically. Will also print a specially designed graphic return address if you like.

VCHECK protects your system against computer viruses. It checks sensitive files in your computer to make sure they haven't been infested.

SETALARM is a simple memory resident reminder that will beep at you at a pre-arranged time.

SILENCE kills the speaker in your PCwhen you don't want to be beeped.

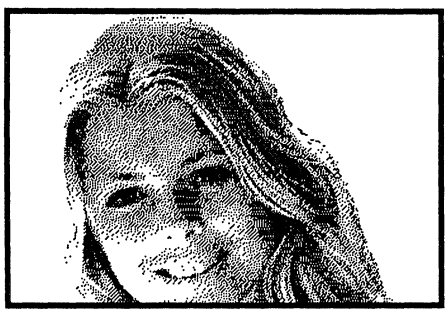
VTREE2 is a new version of the VTREE program on Volume 1. Maps out the tree structure of your hard drive telling you how much space each directory occupies.

WORLDTIME will tell you the correct time in any city in the world.

$19.95

Electronic clip art can turn a dull desktop publishing document into something visually exciting. Having a library of clip art on tap is tricky unless you own a scanner and a suitable source of paper clip art to start with. Almost Free Clip Art solves all this. Each one of our disks contains almost five hundred kilobytes of clip art – at least a dozen images per disk. These collections have been carefully chosen to each contain a variety of interesting pictures suitable for a wide range of applications.These pictures are suitable for use with virtually all applications which accept bitmapped art. This includes Ventura Publisher, Aldus PageMaker, Word Perfect 5 and PC Paintbrush. Each collection comes with a utility to convert the files into MacPaint, Ventura/GEM IMG, PCX and TIFF formats. All of these pictures are in the public domain. You can use them without any copyright restrictions. PLEASE NOTE THAT SOME OF THE FILES ON THESE DISKS ARE NUDES, AND MAY NOT BE SUITABLE FOR YOUNG OR SENSITIVE USERS.

These first two collections represent exceptional value. Costing no more than our regular clip art disks, they contain almost two megabytes of clip art each. Each collection is available on a single quad density disk, or on multiple single density disks for a slight extra charge. Note that these files are provided in the PCX format, which can be used directly with PageMaker and Ventura Publisher. Each collection also includes a copy of our Graphic Workshop package, which will allow you to convert the files into virtually any other format you need them in.



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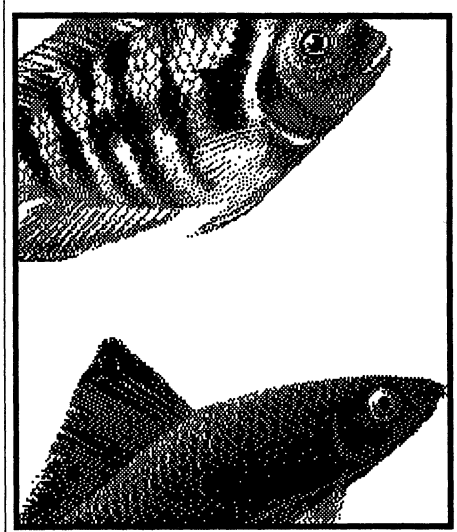

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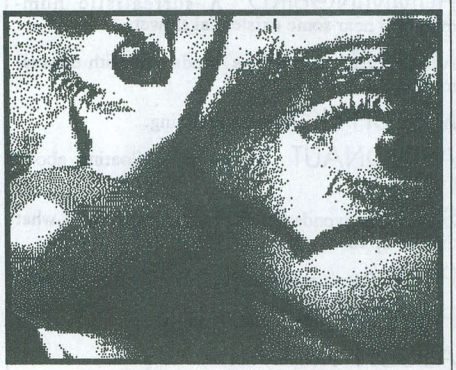

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$19.95

These disks represent the state of the art in computer graphics, digitized full colour images which look like photographs. They can be viewed on any VGA compatible display card and monitor, and the luminous quality of the images will leave you wondering how civilization existed before the advent of 24-bit colour. Most of the pictures have at least 640 by 400 pixels, meaning they'll fill the screen of even a super VGA card. PLEASE NOTE THAT SOME OF THE FILES ON THESE DISKS ARE NUDES, AND MAY NOT BE SUITABLE FOR VIEWING BY YOUNG OR SENSITIVE USERS.

If you own a system with a VGA card, you owe it to yourself to own some of these incredible files. A simple viewing program is included with each disk, and a more powerful image viewing system is available on our GIF User's Toolkit disk, available separately for $24.95. Desktop publishing users will find these files particularly interesting, as they can be halftoned or dithered into superb black and white clip art.

COLOUR CLIP ART VOLUME 7

IRELAND Or a very small part of it.

BARTON A landscape... motel art come to life.

TORNJNS The effects of excessive wear on Levis.

EXCALID A woman and her motorcar.

LEOPARD A big cat.

OCEAN After bathing at Baxters...

HELMET Two of them, actually, along with some aircraft.

BICYCLE Woman on bicycle.

AWAKE Looks like about one in the afternoon.

LENSMIRR A stunning bit of ray tracing.

TIGER1 Another large cat.

BRANDI Almost certainly not her name.

PILLOW A girl and her pillow.

LUNA The moon as seen from somewhere closer than here.

CLOWN A fellow with a large nose and excessive makeup.

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COLOUR CLIP ART VOLUME 6

HUMMINGBIRD A surrealistic hummingbird near some existential flowers.

MARGIE A girl in a windstorm with unusual makeup.

MBDUFFEK Woman reclining.

ASTRONAUT An astronaut floating above the earth.

SILK One wonders if silkworms really know what they're up to.

PIGS Bacon on the hoof, Pink Floyd grounded.

PAULINA Head and shoulders.

ALISON Probably not her real name.

MOLISA A woman of the future, the girl to excite your computer.

VGADNA Part of the double helix.

APPLE A hand painted apple.

RUBENS1 A painting... light, shadow and other artistic stuff.

FANTASIA Mickey Mouse and some special effects.

RUBENS3 More light and shadow.

BEAUTY Conceptual art.

WALRUS A walrus on a rock, singing.

THINKING A woman with something on her mind.

GILDA2 Probably also not her real name.

HENGE Stonehenge at dawn, just before the tourists get there.

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COLOUR CLIP ART VOLUME 5

LILIES Impressively detailed scan of tiger lilies.

BUDGIRLS women on a Budweiser ad.

CRAYBALL is a ray traced picture.

WETSHIRT is a girl in a wet T-shirt.

LOVERS is a fantasy painting of two lovers.

STRIPE is a woman in striped pants.

AMDEK is a beautiful watercolour.

COLOURS is a picture of desert.

CHERIE is a woman in furs.

CABLE3 is a girl named Cable relaxing

PBEAR is a polar bear and her cub.

CABLE4 in which Cable works out.

KIWI is a snack tray.

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COLOUR CLIP ART VOLUME 4

APPLES Two apples... the eating kind, not the litigating kind.

BIRDEYES Abstract bird.

CABLE The second most breathtaking nude GIF file we've encountered of late.

CATFRAME A cat.

DANCERS A victorian print of dancers.

FIRE The first most breathtaking nude GIF file we've encountered of late.

FROGG A really weird looking frog.

GOYA A classical nude GIF file.

LADYHAT A lady in a hat.

PAULINA0 A girl with her clothes on.

ROCKER An abstract of a rocker.

ROOTSV Pythonesque trees.

ROPE Some ropes on a ship.

ROSE A close up of a flower.

SKYLINE A still life.

SUNSET Another still life.

SWORD Warrior maiden in repose.

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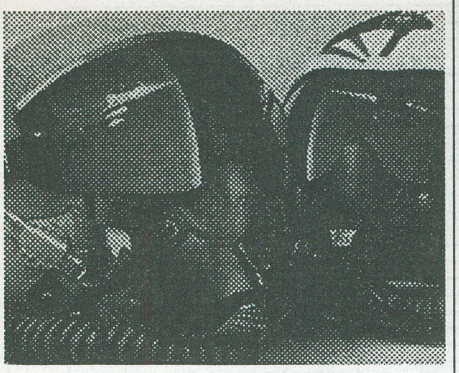
COLOUR CLIP ART VOLUME 3

ANGELA A girl named Angela.
APR89 Woman and machete.
TECH Chrome plated woman.
BALLOON A hot air balloon.
BOUQUET Flowers.
COMDISK A compact disk .
DRHOUS A dream house.
EYE Close up of an eye.



FISH Just before the cat got'em..
JILL Jack's sister.
LEGEND A fantasy scene.
MICKEY Fifty year old mouse.
PANDA Art deco bear.
SANCT Ocean and no dead birds yet.
TAROT Two cards.
TENSPEED A bicycle.
WAVES The ocean revisited.
GODDESS Home perm aftermath.
LOVERS Two people and a fireplace.

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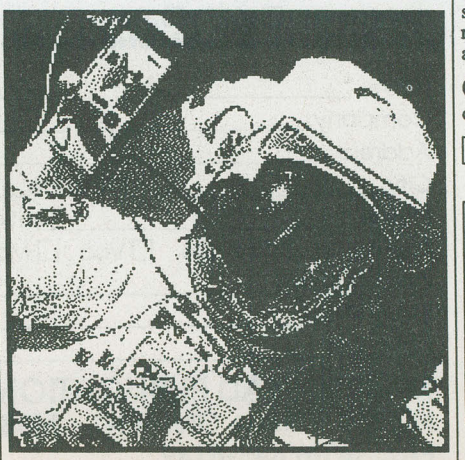
COLOUR CLIP ART VOLUME 2

APRIL A calendar girl.
AZTEC A mural.
BEATLES You remember!
BRONZE A sculpture.
CEZANNE A self portrait.

CIRCUIT A circuit board.
EARTH A well known planet.
LIPS Ahh... lips.
NEST A bird in flight.
P2NUD2 A woman.
PARROT A bird not in flight.
SAX The instrument.
SURFER Man, board, tube.
THISTLE A seed pod.
WHALES ...and ruins.
FRAISE French strawberries?
GLASS from the twilight zone.
BEE An insect.
DOGS1 Actually, only one.
CATS10 2 cats, 1 hat, no ham.
GORILLA A famous image.
TETCHA A dusky maiden.

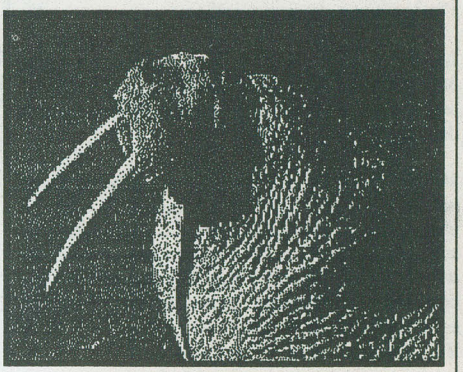


ALMOST FREE GIF USERS KIT

The incredible popularity of our GIF file colour clip art collections has prompted us to assemble this toolkit of programs for people who buy our GIF disks. It contains more and better programs than we've been able to include on the GIF disks themselves due to space constraints.

If you've bought one of our GIF collections, please check out this disk. It will make your GIF files a lot more interesting and quite likely a lot more useful as well.

This collection comes on two dual density floppies. It also includes several sample GIF files.



GRAPHIC WORKSHOP is the last word in graphics programs. It views, converts, dithers, halftones and prints all popular image files. It works with MacPaint, GEM/Ventura IMG, PC Paintbrush PCX, GIF, TIFF and EPS files and drives CGA, Hercules, EGA, VGA, ATI VGA Wonder and Paradise cards.

GRAFCAT Prints up a visual catalog of your image files to either a PostScript or LaserJet Plus compatible laser printer. Each page will contain sixteen images. GRAFCAT accepts any mixture of IMG, MacPaint, PCX and, of course, GIF files. The GIF images are dithered to black and white for easier viewing.

VGACAD is a public domain GIF paint program. It allows you to edit and even create your own two hundred and fifty-six colour GIF files. This is a first class package, and a lot of fun. Requires a mouse and a VGA card.

CSHOW is the best GIF file viewer yet written, and this is the latest version of this powerful package. It features panning over large files, a directory selection menu, loadable support for super VGA modes, colour palette adjustment and all the bells and whistles you could ask for.

GIFWP converts GIF files into Word Perfect compatible graphics files.

$24.95 (2 DISK SET)

35 MM SLIDES FROM GIF FILES

We can arrange to make your stunning GIF files into equally stunning... and surprisingly inexpensive... 35mm slides using a high quality film recorder. For more information contact Alchemy Mindworks Inc., P.O. Box 500, Beeton, Ontario L0G 1A0

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GUARANTEE: If you buy a disk from us and you have problems with it, contact our technical support line during normal business hours at (416) 445-5600. If you buy a disk from us and you don't like it... for any reason or no reason... simply return it and we'll refund your money or exchange it for another disk.

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USER SUPPORT: Most of the software and files in this catalog comes from sources who request support from its end users (you). In paying for these disks, you have paid for the collection, testing and distribution of the software. You have not paid its creators. Please support shareware authors.

LIABILITY: While every effort has been made to ensure that the software in this catalog is free of bugs and viruses, no liability is accepted for any loss or damage caused by its use.

HARDWARE: If you inadvertently order software which is not suitable for your computer, you are, of course, free to return it. However, to avoid delays we suggest that you ascertain that the programs you order will work on your equipment. For example, if your computer has a Hercules card or old style CGA only card, many of the programs which require EGA or VGA graphics cards will not work on it.

PAYMENT: You can pay for your software by enclosing a money order or personal cheque. Note that orders paid for by cheque will be delayed for approximately ten business days to allow for clearance. You can also order by credit card... we accept Visa, MasterCard and American Express. Please quote your name as it appears on your card, your card number and expiry date. For faster service, you can order by phone during normal business hours at (416) 445-5600. We can also accept orders by FAX at (416) 445-8149. Phone and FAX orders must be paid for by credit card.

DISK CORRUPTION: Occasionally the post office will corrupt the data on disks sent through the mail. If this happens, you will encounter CRC check errors when you attempt to unpack the software on your disk. In this case, simply return the disk to us for an immediate replacement.

COMPRESSION: The software on these disks has been archivally compressed to get more software on each disk. As a rule, plan on getting two actual disks worth of unpacked software for each disk you buy. The uncompression process is handled automatically when you first use your disks. Complete instructions for the use of any disk bought from us can be found in the READ.ME file on the disk.

Please note that these disks do presuppose a reasonable familiarity with DOS and the workings of your computer and applicable software.

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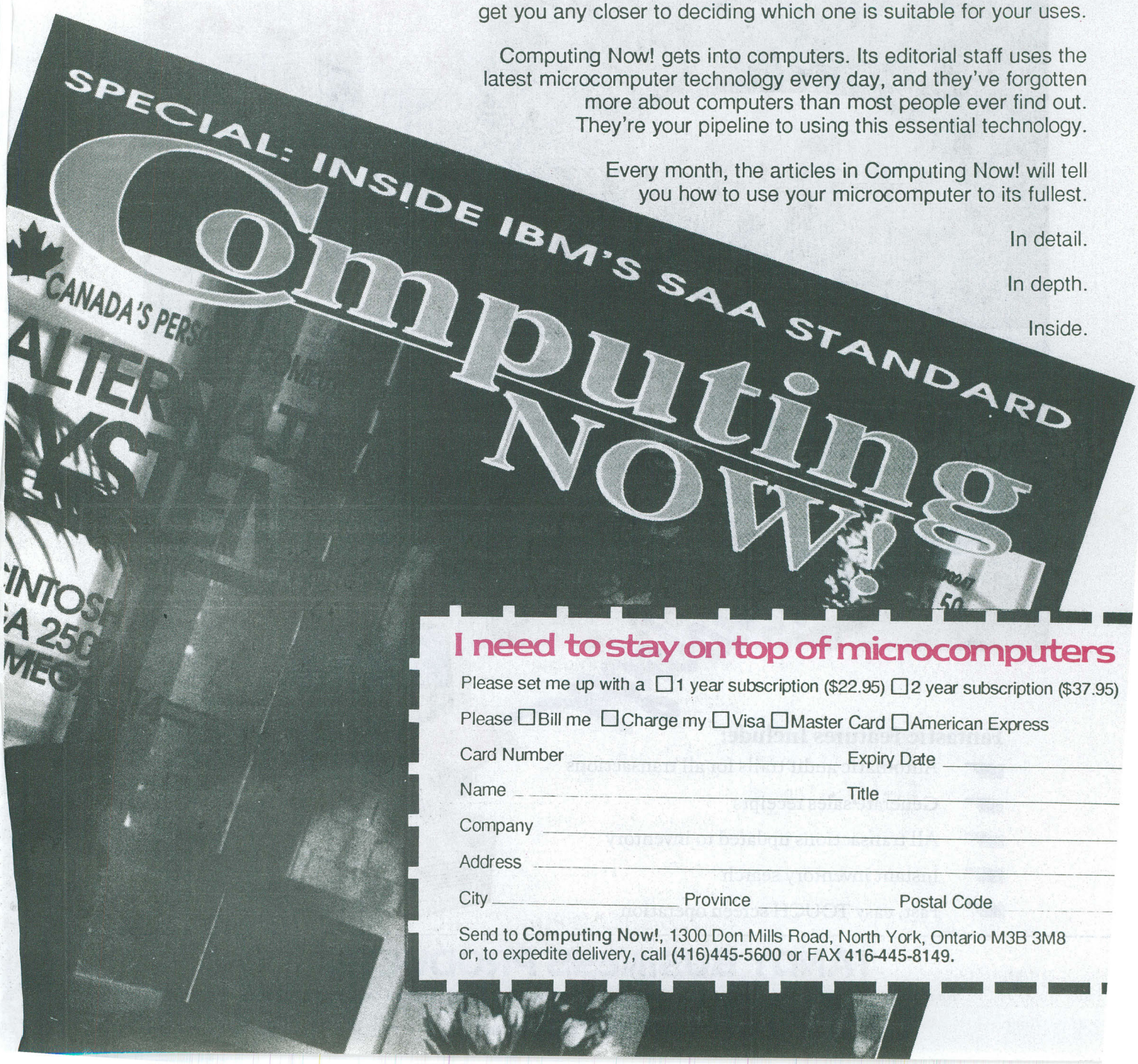

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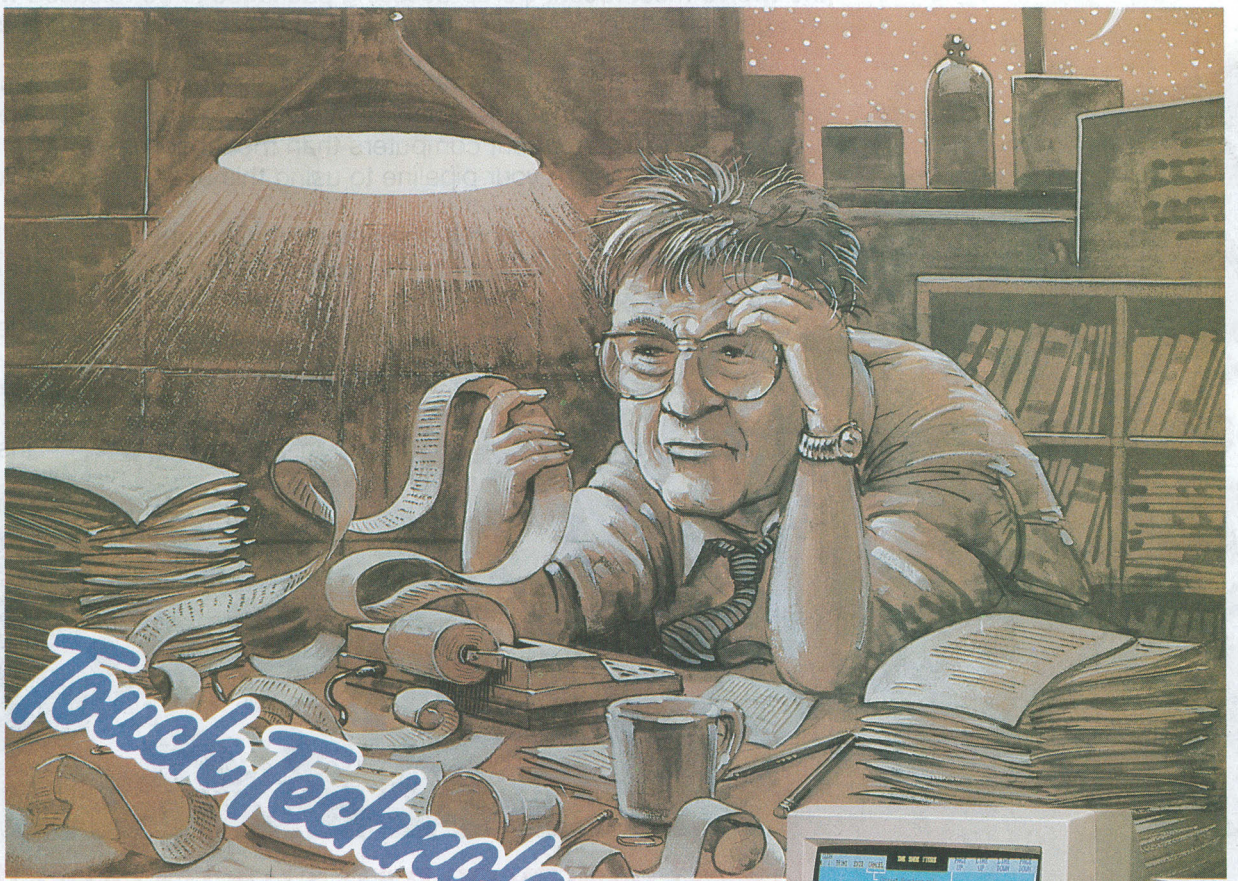

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PROJECT

Electronic Analog/Digital Multimeter

A versatile test instrument for the workshop.

Mark Stuart

The design of an Electronic Analog/Digital Multimeter was a very interesting exercise in compromise. During the course of its development a great deal of respect was gained for the designers of what were considered to be "ordinary" commercial instruments.

The basic electronic circuits for Voltage, Current, Resistance, and AC Measurements are fairly easy to deal with when taken individually, but combining them into a compact hand-held unit with a single range switch is another matter.

After some thought, it was concluded that the only solution suitable for home construction would be a bench meter and to incorporate a number of separate range switches. The idea of a single multi-pole multi-way switch was considered, but the price and the complicated wiring that would be necessary completely ruled this out.

Two advantages of using separate range switches are that the switches can be printed circuit board mounting types — so eliminating wiring and wiring error and that parts of the circuit can be built separately and used individually in other applications.

The indicating device specified is a panel meter with a 100uA sensitivity. This is modified by means of a series resistor to read 0-1V. Almost any standard panel meter can be used, or instead one of the new digital panel meter modules could be added.

The overall performance of the meter is very good; its frequency range when measuring AC voltages and currents is good up to 50kHz and the input impedance of 10 megohms on all voltage ranges gives good accuracy in high impedance circuits where a normal analog multimeter would be useless.

In addition to the standard range the meter has an AC Millivolts circuit which allows audio frequency measurements from 3mV RMS up to 1V and is very useful for testing amplifier signal levels, microphone and pick-up outputs, frequency responses and general signal tracing.

The resistance ranges have the benefit of a linear scale that reads from left to right instead of the usual non-linear, reverse reading scales; also the probes are correctly polarized — that is, red is positive — when making Ohms checks. All resistance measurements are made at a maximum of 100mV so in-situ measurements will not be affected by transistors, ICs and diodes in the circuit.

Other features are that the meter is protected form overloading by a fuse and electronically, and measurements up to 1000V and 10A AC and DC are possible. The meter is built in a fully insulated case for safety.

Circuit Description

The full circuit diagram for the Electronic Analog/Digital Multimeter is shown in Fig. 1. For clarity each section will be described separately.

Voltage

Inputs for voltage measurements are applied to the voltage divider chain made up of resistors R2 to R7. Voltage ranges are selected by S1a, which taps off a proportion of the input voltage from the divider chain and passes it to IC1, the input amplifier circuit.

On the 1kV range an extra resistor (R1) is added to the top of the divider. To avoid having high voltages on the circuit board this resistor is made up from a series combination of values which are sleeved and mounted in the lead to the 1kV terminal (SK3).

The input impedance of the circuit is set by the total combined value of R2 to R7 which is 10 Megaohms. In order to make accurate measurements on all ranges it is essential that the input amplifier circuit have an impedance which is in excess of 50 Megaohms.

Use of a FET input amplifier IC, TL071, and careful board layout ensures that this is achieved. IC1 does not have any gain, but it acts as a buffer circuit with a very high input impedance and a low output impedance.

From IC1 the signal passes to a second amplifier stage IC2 via resistor R32. S1b switches resistor R33 in and out of circuit on alternate ranges to give the 3V, 30V, and 300V ranges.

The combination of resistors R32 and

R33 is such that the signal is reduced by 3 to 1 on each of these ranges but remains unaltered on the 1V, 10V, and 100V ranges. The amplifier IC2 has a gain of 10 and its output is applied to the meter movement via switch S5 when DC measurements are selected.

AC Voltage

The circuit as far as the output of IC2 is identical for AC and DC ranges. Capacitors C1, C2, C3, C4 and C5 correct for the effects of stray capacitance and maintain a level frequency response to about 50kHz.

When AC measurements are made the meter is connected via switch S5 to the output of the rectifier circuit IC5. This circuit takes its input from IC2 and produces a half-wave rectified output which is averaged by the meter movement to give a steady DC reading.

Diodes D3 and D4 in the feedback loop around IC3 are connected so that on negative half-cycles the output stays at 0V, but positive half-cycles are passed normally with a gain of just over 2.

The value of gain is selected so that the meter reads the average value of the incoming signal and indicates the correct (RMS) voltage. As with all meters the accuracy of a.c readings depends on the signal waveform. Sine waves are the most frequently encountered and so the meter is set to read correctly for these.

Diodes D7 and D8 across the meter protect it from being overdriven when switching ranges etc. Diodes D1 and D2 provide similar protection for IC1.

Current

On the Current range the shunt resistors R8

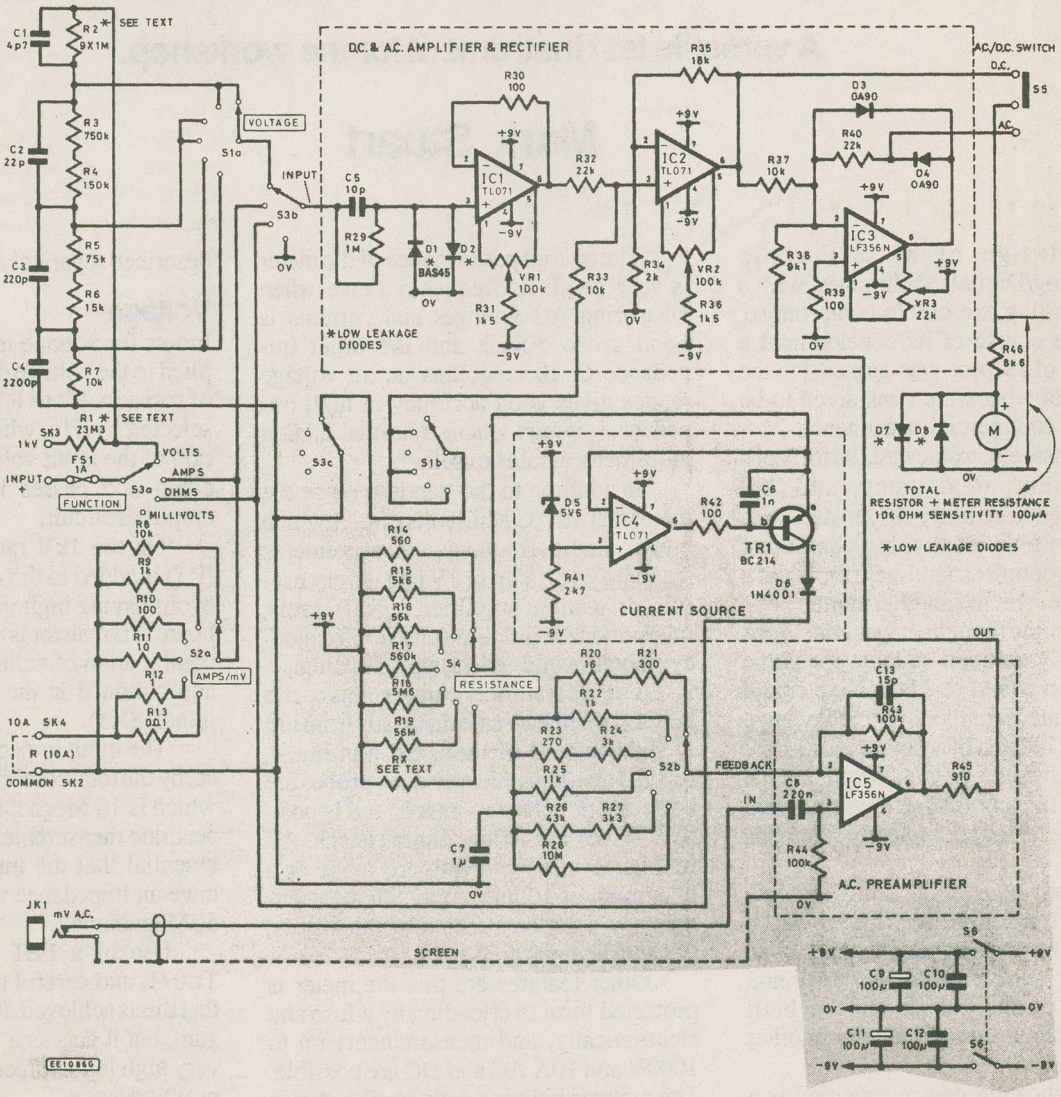

Fig.1. The complete circuit diagram for the Analog/Digital Multimeter. The "active" sections of the circuit are shown within the dotted boxes. The low noise diodes are type BAS45.

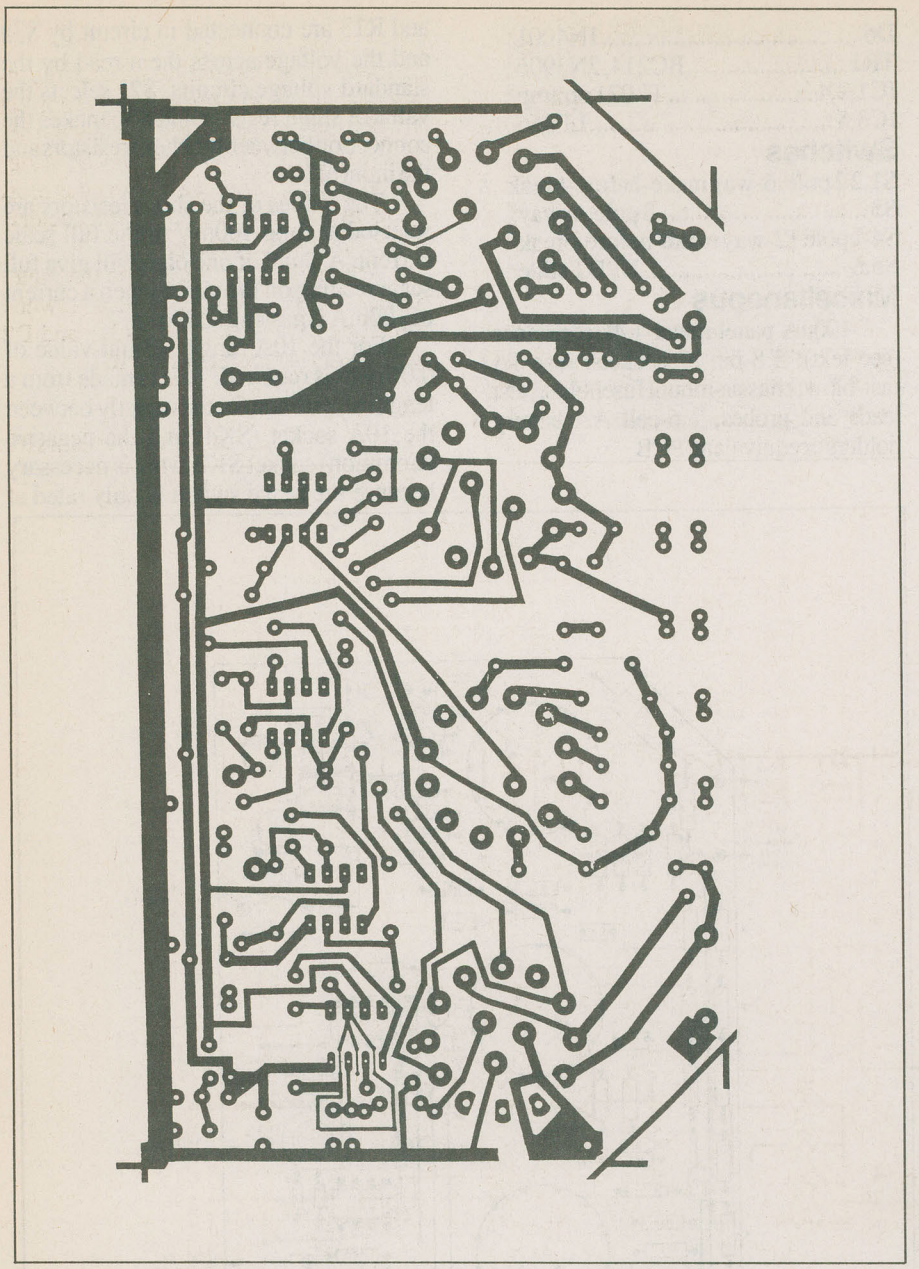

Fig. 3. The full size printed circuit board foil pattern.

1A, and the PCB copper tracks would have to be huge to carry 10A comfortably.

The AC and DC current measurements are treated by the amplifier section in exactly the same way as voltages. The current ranges increase in direct decades (X10) so that the use of S1b is not involved. Switch S3c ensures that this is switched out of circuit on all ranges except voltage.

Resistance

Resistance is measured by passing a known constant current through the resistor under test and measuring the voltage drop across it using the standard voltage circuits.

The current source consists of IC4, transistor TR1, and associated components.

A reference voltage of 5-6V from Zener diode D5 is connected to the non-inverting input of IC4. Negative feedback around IC4 via TR1 and resistor R42 works in such a way that the emitter voltage of TR1 is made equal to this reference voltage. This means that 5-6V appears across whichever emitter resistor is selected by S4.

This constant reference voltage across a fixed resistance value gives a constant current output at the collector of TR1. As the reference voltage is 5-6V a 5k6 range resistor give a current of 1mA. The standard voltage circuit, which is connected via S3b, gives full scale deflection for 100mV. A range current of 1mA thus gives a full scale reading of 100 ohms. Low value resistors drop less voltage and so the reading is directly proportional to the resistor value.

On the higher resistance ranges the current becomes rather too small for comfort. For example on the 100k range a current of only 1uA is required. The 1M and 10M ranges require 0.1uA and 0.01uA respectively. A current of 0.1uA is just about the limit of the circuit, so readings on this range will not be too accurate, and a 10M range is impractical.

The middle resistance ranges are accurate and linear, and much easier to use than a standard meter. No compensation has been made for wiring and test lead resistance, so on the lower ranges 100 ohm and 10 ohm, an offset zero will be present when the test leads are short circuited. This value should be subtracted from any measured resistance value to give the true reading.

AC Millivolts

The measurement of AC Millivolts is made by first amplifying the input to 1V and using the standard rectifier circuit IC3.

The AC Preamplifier, IC5, is connected to IC3 via resistors R45 and R38. The gain of IC5 is set by the feedback resistor R43 and the range resistor selected by S2b. The values of resistors R20 to R28 are chosen to given ranges of 1V 300mV, 100mV, 30mV, 10mV and 3mV. The frequency response is level up to 100kHz except on the 3mV range where it is slightly lower.

When making measurements on the mV range the input of IC1 is connected to 0V by S3b so that stray inputs do not interfere. In a similar way the input of the mV range is shorted out when the input lead is disconnected by use of a switched jack socket (JK1).

The input impedance on this range is set to 100 kilohms by the input resistor R44.

Power Supplies

The Multimeter circuit consumes very low current, but as meters tend to be used frequently it is recommended that two sets of six AA cells be used. Battery holders are often available with clips identical to those used on the small rectangular 9V batteries. If so, the battery holders can use these as

Parts List

Resistors

R1 ..... 23.3M (series, see text)
R2 ..... 9M (series, see text)
R3 ..... 750k
R4 ..... 150k
R5 ..... 75k
R6 ..... 15k
R7,8,33,37 ..... 10k
R9,22 ..... 1k
R10,30,42 100
R11 10
R12 1
R13 ..... 0.1
R14 560
R15 ..... 5k6
R16 ..... 56k
R17 ..... 560k
R18 ..... 5M6
R19 ..... 56M
R20 16
R21 300
R23 270
R24 ..... 3k
R25 ..... 11k
R26 ..... 43k
R27 ..... 3k3
R28 ..... 10M
R29 ..... 1M
R31,36 ..... 1k5
R32 ..... 22k
R34 ..... 2k
R35 ..... 18k
R38 ..... 9k1
R39 100
R40 ..... 22k
R41 ..... 2k7
R43,44 ..... 100k
R45 910
R46 ..... 8k6 (see text)
R(10A) ..... 0.01 wire (see text)
All .25W 1% except as noted

Potentiometers

VR1,2 ..... 100k trim
VR3 ..... 22k trim

Capacitors

C1 ..... 4.7p
C2 ..... 22p
C3 ..... 220p
C4 ..... 2200p
C5 ..... 10p
C6 ..... 1n
C7 ..... 1u 100V
C8 ..... 0.22u
C9,11 ..... 100n
C10,12,13 ..... 15p

Semiconductors

D1,2,7,8 BAS45 low noise (see text)
D3,4 ..... OA90 (see text)
D5 ..... 5V6 Zener
D6 ..... 1N4001
TR1 ..... BC214, 2N3906
IC1,2,4 ..... TL071 op amp
IC3,5 ..... LF356

Switches

S1,2 2 pole, 6-way make-before-break
S3 ..... 3 pole, 4-way
S4 1 pole 12-way make-before-break
S5,6 ..... DPDT slide

Miscellaneous

100uA panel meter 1.4k resistance (see text); 5 8-pin IC sockets; fuse 1A fast-blow; chassis-mount fuseholder, test leads and probes, 2 6-cell AA battery holders or equivalent, PCB

and R13 are connected in circuit by S3a and the voltage across them read by the standard voltage circuits. S2a selects the value of shunt resistor and S3b makes the connection between the shunt resistors and the input of IC1.

The values of the shunt resistors are selected to drop 100mV at the full scale current. A shunt of one ohm will give full scale reading on the meter when a current of 100mA is passing and so on.

For the 10A range a shunt value of 0.01 ohm is required. This is made from a length of wire connected directly between the 10A socket (SK4) and the negative (Common) socket SK2. This is necessary because the range switch is only rated at

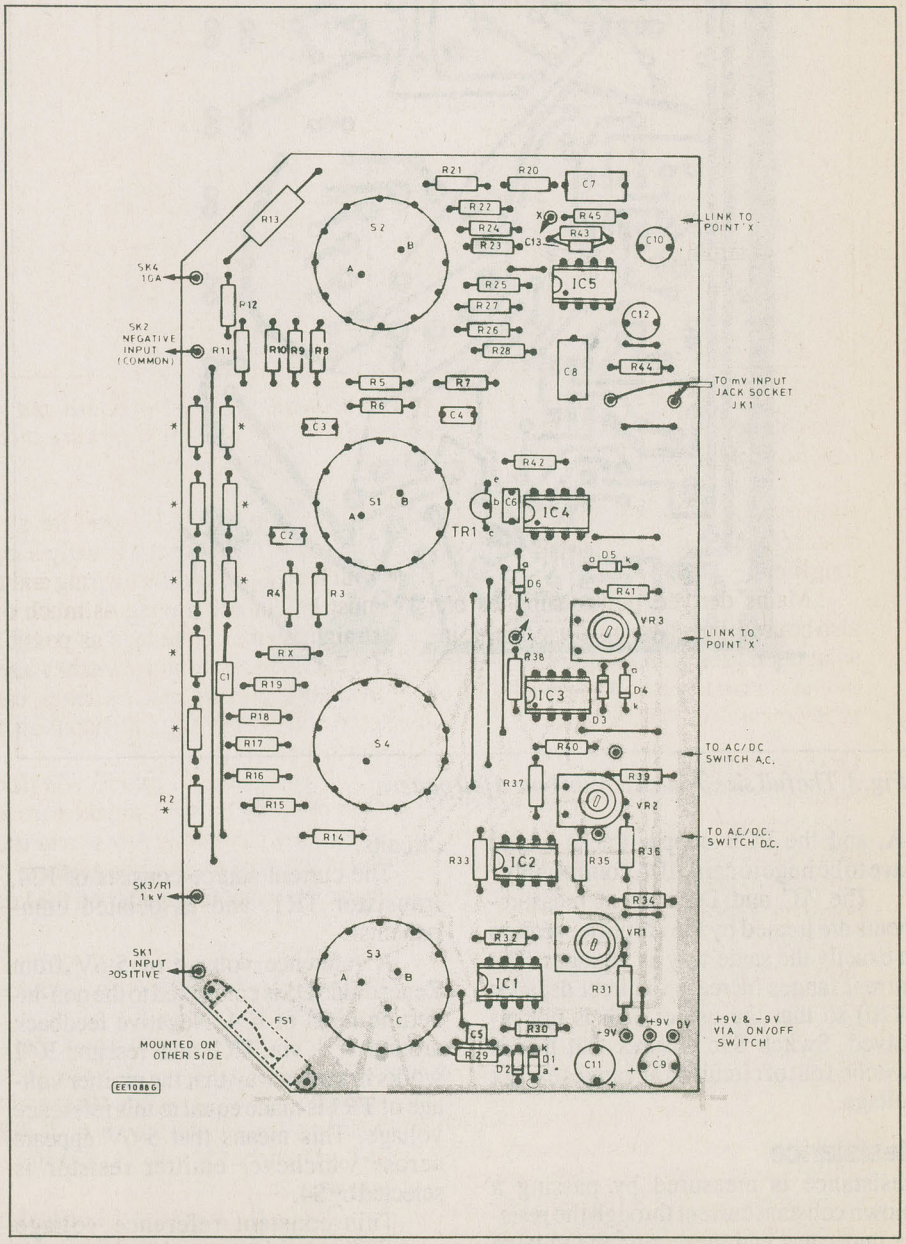

Fig. 2. Component layout on the printed circuit board. Note that the long link wires should be made with plastic insulated connecting wire.

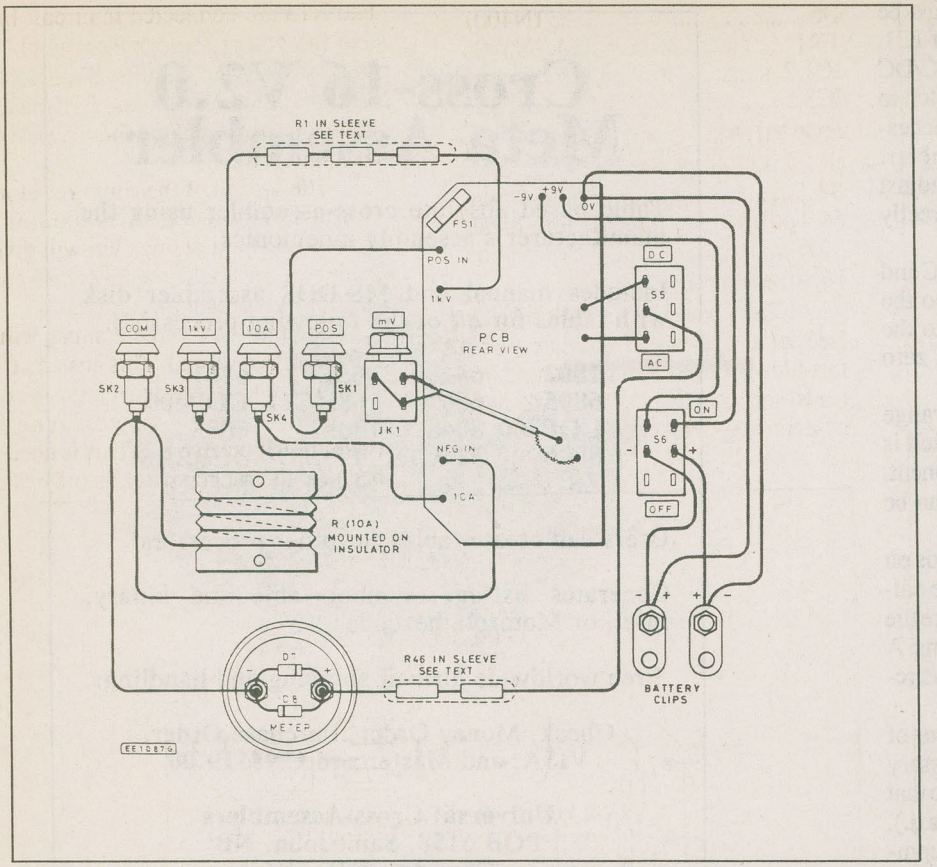

Fig. 4. Interwiring details for the off-board components. The circuit board and components are all mounted on the rear of the front panel. The series resistors are encased in plastic sleeving.

shown in Fig. 4. These can be standard or re-chargeable types, and should give very long life.

Mains derived power supplies can also be used, but take care to use double insulated circuits *without* a ground on the output side as this could cause all sorts of problems with ground loops.

Construction

As the circuit is all built on a single printed circuit board the assembly is fairly straightforward. Fig. 2 shows the component layout and Fig. 3 the printed circuit board track pattern, full size.

Begin assembly by fitting the wire links as shown. The longer links should be made with insulated wire while the shorter ones can be made from offcut resistor leads.

As there are a lot of resistors and most of them carry the five-band one percent color code system, it is necessary to be rather careful to get the correct values in the right places. Any errors will give odd ranges which may not be easy to spot as the meter may appear to be working perfectly.

Sockets should be used for all ICs. The rotary switches are usually supplied with loop tags for direct wiring and these must be cut off leaving as much of the straight stems of the tags as possible. If PCB-mounting rotary switches are not available, panelmount switches can be used with the appropriate hoookup wires run to the PCB.

Switches S1, S2 and S3 will fit more than one way around, so take care to set them fully counterclockwise and use the flat of the shaft as a guide to get them right. Remember that the pointer on the knob is exactly opposite the flat on the spindle. If you get it wrong and don't want to unsolder the switch, screw fix knobs are a good alternative way out.

Capacitor C1 is mounted between two distant points — its leads must be sleeved and may need extending to fit the board centers. Make sure that all diodes, and capacitors C9 and C11 are the right way around.

The final component to be fitted to the board is the fuseholder which is fitted to the track side to keep easy access to the fuse. Once the board assembly is complete connect the necessary wires to the board. The mV input should use shielded cable, the other input socket connections should be made with 16/0.2 wire.

Resistors for the 1KV socket should be fitted in a length of sleeving between the board and the input socket. The 10A shunt is made from a 71cm length of 18swg enamelled wire connected directly between the 10A socket and the negative (Con) socket SK2. The wire can be loosely wound on a flat piece of insulating material.

The wiring diagram, Fig. 4, shows how the shunt can be fitted and the wiring to the other parts of the board from the sockets.

Resistors and Diodes

R1 is 23.3M, and is made up by using 2 20M and one 3.3M soldered in a series string. R2 is 9 1M resistors in a series string. These should be enclosed in a short length of plastic tubing.

R46, in series with the meter coil, should be chosen so that R46 plus the coil resistance add up to 10k. The chosen value of 8600 ohms will work with 1400-ohm meters.

The diodes D1,2,3,4,7, and 8 are selected for very high performance. However, since these diodes are very difficult to find, you can use the common 1N914 or 1N4448 without much loss of performance.

Testing And Setting Up

The thorough testing of a meter of this type presents quite a problem. The wide range of accurate voltages and currents necessary to check each range fully is not likely to be available even in electronics workshops. The best way is to make comparisons with other meters using whatever sources of voltage and current are available. It is possible that a local training center, school or college will be able to help, so ask around.

Fine tuning of capacitor values C1, C2, C3, C4 and C5 may be undertaken by those determined to extract the very best from the meter. There components affect the frequency response on the AC Voltage ranges. Capacitors C1 and C5 in particular have a large effect and should be changed only if a good reliable sine wave source of 0-100kHz or more is available.

If no test gear is available it is safe to say that the meter should work accurately first time provided no errors are made in assembly.

Electronic Analog/Digital Multimeter

There are three presets that must be set up to remove the zero offsets of IC1, IC2 and IC3. To do this, set the AC/DC switch S5 to DC and the Range switch to mV. Link pin 3 of IC2 to 0V and if necessary adjust VR2 to zero the meter. Remove the link and if necessary adjust VR1 for zero. These two are now correctly set.

Next set the AC/DC switch to AC and turn VR3 until the meter deflects to the right. Back of the setting of VR3 to the point where the meter just touches zero and the settings are complete.

The accuracy of the Ohms range depends on the Zener diode D5 which is specified as a five percent component. More accurate voltage references can be obtained and substituted if required.

The value of resistor R46 depends on the meter being used. Its value can be calculated easily as its function is to make the meter resistance value up to 10 kilohms. A meter of four kilohms resistance thus requires a six kilohms resistor and so on.

It is also possible to use meters of other current ratings, all that is necessary is to set the meter and series resistor so that 1V gives a full scale deflection (f.s.d.). Thus a 1mA meter would need a combined meter plus series resistor value of one kilohm. A 50uA meter, 20 kilohms; a 500uA meter, 2 kilohms, etc.

On AC ranges the averaging effect of some types of meter may be affected by the diode (D4) in the drive circuit. A 1k resistor from D4 cathode to 0V line overcomes this and allows any type of meter to be used.

Safety

For complete safety an *insulated* case is *essential* where high voltage readings are to be made. It is also necessary to add some shielding to the meter electronics.

The best way to combine these two functions is to use a plastic case with a metal front panel overlaid with a Paxolin insulating panel. The metal panel should be connected to the 0V point in the circuit.

Decibel Ranges

The dB Range on the meter is set to be accurate on the AC mV Ranges. On the 1V AC Range (mV) the 0dB point represents the universal 1mW in 600 ohms. Each range down from this subtracts exactly 10dB so relative measurements are easy.

The use of dB scales is a difficult subject for beginners and it is not intended to go into details here. ■

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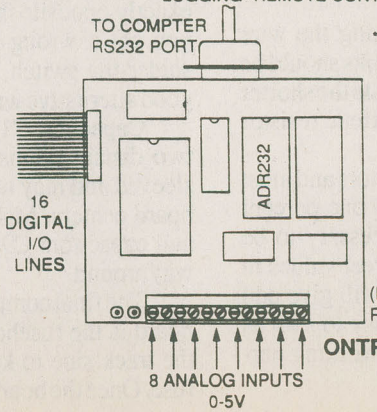

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The Current Ring

A novel device for convenient AC troubleshooting and current detection.

Bill Markwick

The Current Ring™ indicator is a small (1") moulding that contains a multiturn coil. The wire under test is passed through a hole in the centre and an AC current flowing through this wire will trigger an LED fitted into the top. If you make only one pass through the model CR-5/16 Current Ring indicator, a current of two amperes is required for triggering. With two passes it drops to one amp, and with five, only 150mA is required. The maximum possible current is 150A, and the ring contains a back-to-back zener and a current-limiting resistor.

This device makes it very simple to detect the presence of a flow in a power circuit; you can slip the current ring onto part of the circuit and continue testing elsewhere. Another use is the very simplest installation of a pilot light — all you have to do is mount the Current Ring on a panel with the MB-5/16 mounting bracket and slip a current-carrying wire through the device.

Remote Sensing

If the on-off LED function isn't enough, the indicator is available with wire leads instead of the built-in LED (model CR-5/16-WL). If a burden resistor is placed across these leads to linearize the output, the indicator will provide 10mV for each ampere of AC current, ideal for most DMMs (certainly a more convenient method of measuring high current than inserting a series resistor).

The turn-on point of the LED can also be controlled by connecting a fixed or variable resistor across the leads of the CR-5/16-WL. One suggested use is to place the indicator over a lead feeding a power-correction capacitor and adjust the shunt resistor so that the LED turns on with normal current. Extinguishing of the LED would then indicate an undesirable high impedance within the capacitor.

An LED (the CR-LED) and an LED panel holder (the CR-PH) are available for the CR-5/16-WL; the LED may be up to 200 feet from the sensing indicator. Note that the LED is a special bipolar red/red type for direct operation on AC, though you do have to supply an external current-limiting resistor.

The two types of indicators should prove invaluable to both appliance troubleshooting and industrial process monitoring.

The Current Ring™ series is available from Vrolet Instrument Co., 3017 St. Clair Avenue, Burlington, Ontario L7N 3P5, (416) 634-9540, Fax 634-9095; in Toronto (416) 827-8233.

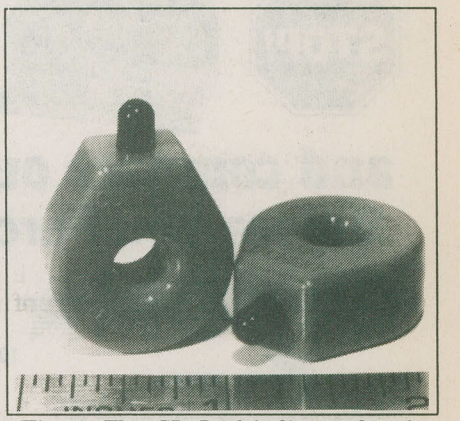

Fig. 1. The CR-5/16 indicator has its own built-in LED.

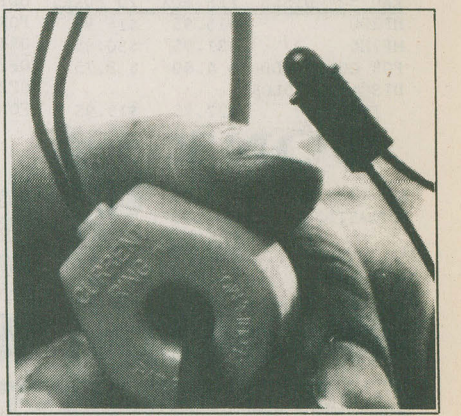

Fig. 2. The CR-5/16-WL has wire leads for use with external LEDs or current meters.

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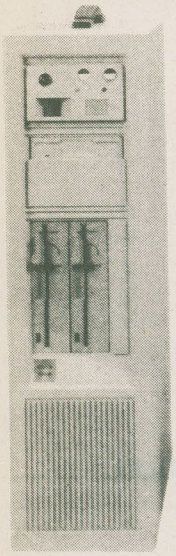

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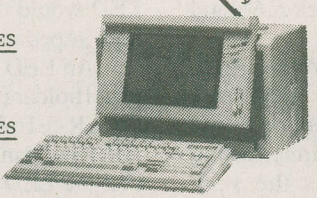

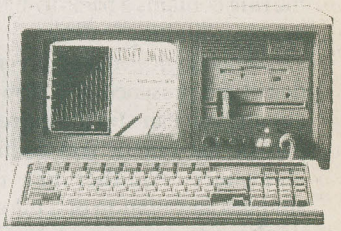

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FEATURE

Techie's Guide to C Part 15

One of the less than obvious aspects of C programming is how return values are handled. This month we'll scrutinize the registers.

Steve Rimmer

A C language program ultimately consists of functions called by functions called by functions and so on until you work your way back up the tree to the *main* function, which is called by DOS. This structure imposes a simple, easy to understand order on the potential spaghetti dinner of writing a program. A function is any black box which accepts zero or more values and optionally returns something.

Under C, the nature of "something" is largely left up to your imagination, and the way in which you deal with the things your functions return will influence the structure of the code you write in C. The effective use of return values will go a long way towards making your programs compact, understandable... and functional.

Unfortunately, without understanding how return values really do their magic, it's quite easy to tell C to perform something with one that it can't do. It's just as easy to pass over opportunities to create more effective code.

What Goes Up...

There's a very simple rule for return values under C. Things passed *to* a function are stored on the stack, using the techniques we have discussed previously. Things which are returned *from* a function are always stored in the machine registers of the processor of your computer. In this way, the return value of a function can be ignored or used at the discretion of the calling function.

You might consider the *getchD* library function under C, a function which waits for a keyboard character when it's called and returns it as the low order byte of an integer when someone actually wakes up and belts a key. Now, you can use this to actually see what the next key is by doing something like this.

```
a=getch();
```

or you can just wait for a keypress...

```
getch();
```

In the first case, the variable *a*, presumably some memory on the stack, will be loaded with the value returned by *getch*. In the second, the registers are all ignored when *getch* returns.

The return values of C functions always appear in predictable registers. For sixteen bit values such as *int*s and pointers under the small memory model, the return value is stored in the AX register. For functions which return *char* values, the returned value can be found in the AL register. For functions which return thirty-two bit values, or far pointers consisting of segment and offset values, the low order word is returned in AX and the high order word in DX.

If you keep in mind that whatever you return must fit into the available registers... into thirty-two bits for most applications which do not involve floating point numbers... you'll avoid a number of obvious problems.

In theory, any object can be returned by a function. In practice, as we've seen, this is not so. For example, this would not work.

```
struct ffblk getfirst(s)
char *s;
{
struct ffblk f;
/* ...some code goes here */
return(f);
}
```

This function returns a forty byte struct variable... or, at least, it thinks it

does. As we've just seen, you can't actually do this. What you could do is this:

```
struct ffblk *getfirst(s)
char *s;
{
struct ffblk f;
/* ...some code goes here */
return(f);
}
```

This second function returns a *pointer* to a forty byte struct, which *is* something C can do. In this case, the actual returned value is a sixteen or thirty-two bit value, which will fit in the available registers.

As an aside, if you're interested in seeing what the actual returned values from functions are, you might want to nose around using some "pseudo-variables" provided under Turbo C. If you were to put this line of code in your program,

```
printf("AX=%X",_AX);
```

the value of the AX register at that point in your code would be displayed. There are similar pseudo-variables for all the useful 8088 registers under Turbo C... you can use them to see what really comes back from C functions if you like.

The second version of our imaginary function, above, has a problem too... but it's very obscure. If you were to write such a function, the results would probably be useless. They would be correct when the function returned... the returned value would point to a valid *ffblk* struct in this case... but it wouldn't stay that way very long.

Recall that variables allocated within functions are actually placed on the stack for the life of the function and then thrown away. The returned value of our function, then, would point into a stack variable which would have been deallocated just before the function returned. If you call another function before you use the data... or if a keyboard interrupt were to be thrown, for example... the data in this variable would be overwritten and the value returned by the function would find itself pointing to garbage.

The solution to this problem is to have C allocate the variable in a place which will not be overwritten. This type of storage is called *static*... it's allocated when the program starts up and survives untouched even when the function which owns it isn't being used. Here's how this works.

```
struct ffblk *getfirst(s)
char *s;
{
static struct ffblk f;
/* ...some code goes here */
return(f);
}
```

This function will return a pointer to valid data. When you return pointers from functions, it's extremely important that you take care to make sure that whatever you're pointing to will actually exist when it ultimately gets used.

Pointer Checking

Unless it's told otherwise, C assumes that all functions returned signed integers. You can tell it otherwise by declaring at least a partial *prototype* for a function like the one we've been looking at somewhere near the top of your program. You would say this:

```
struct ffblk *getfirst();
```

This tells C to expect a pointer to an *ffblk* struct from *getfirst*, rather than an *int*. In a large model program, this means to expect a thirty-two bit number rather than a sixteen bit one, and failing to do this can result in some pretty spectacular system crashes if you attempt to write to an illegal pointer created in this way.

This prototype also helps C type-check your code. Not only does it know that *getfirst* returns a pointer, but it also knows what sort of pointer it can legally be assigned to without a cast. This would cause the compiler to complain,

```
char *p;

p=getfirst("*.*");
```

whereas this would not.

```
struct ffblk *p;

p=getfirst("*.*");
```

Both variables actually have the same structure, but C keeps you from accidentally interchanging them.

Return Ticket

It's important to realize that a return value can be used just like a variable. For example, allowing that a hypothetical function called *message* returned a pointer to a string, you could print the string this way.

```
char *p;
p=message();
puts(p);
```

You could also do it this way.

```
puts(message());
```

Let's further hypothesize that the function *message* returns a string based on an error code, as returned by the function *screwup*. You could so this,

```
int i;
char *p;

i=screwup();
p=message(i);
puts(p);
```

or you could be much more elegant.

```
puts(message(screwup()));
```

In nesting return values like this, it's important to note that the innermost function will always be called first, its return value evaluated and then passed as an argument to the next innermost function, and so on.

You might well ask whether the nested version actually creates better or tighter code... or if it just looks like it does. The answer is not all that clear. In theory, the registers set by *screwup* should be pushed directly onto the stack and *message* should be called. This would be decidedly more efficient than saving each value in a dedicated stack variable. In practice, your complier may or may not always handle things this way. It very often likes to create temporary stack variables behind your back to hold the results of nested function calls like this one, minimizing the actual space and time saving of such a structure. This will usually be the case if your nested functions involve one or more functions which accept more than one argument.

In the above example, the compiler should not have to use any temporary variables, and the result should be much tighter code through using nested return values.

The most important thing to remember about using the values that are returned by your functions is that they behave like normal C values... *int*s, pointers and so on... and should be treated as such. As long as you apply the same rational to them what you would to other C numerical entities they won't creep up behind you and grab you by the ears. ■

FEATURE

Designing with Logic, Part 2

Understanding hardware design with logic involves understanding binary arithmetic. This month we'll look at the basis of binary numbers.

Steve Rimmer

You can't really design logic circuitry from an electronic point of view... or, at least, attempting to do so is exceedingly frustrating. Traditional concepts of signals and amplitudes don't really apply to logic. In its place, one has to start thinking about things in terms of data.

A single logical state is usually pretty meaningless. Combined with other logical states, however, it may represent data and hence the true "signals" of logic. This takes some getting used to when one is thinking about how logic works, and considerable head scratching when one is trying to debug the stuff.

This month we're going to have a look at the basis of digital data, binary numbers. While a bit awkward unless you were born with sixteen fingers... and like to count on them... binary arithmetic is the fundamental key to understanding logic design. Without it, you'll probably drive yourself insane trying to design half adders and counters as if they were radios.

Count by Twos

Numbers of the sorts we're used to work in base ten. Computer numbers work in base two. We are predisposed to think of things which happen in clumps of ten, that is, ten things, groups of ten things, groups of groups of ten things and so on. This corresponds to the positions in a decimal number. The rightmost digit represents the number of things up to ten. The next to rightmost digit is the number of groups of ten, followed by the number of hundreds, or groups of groups of ten.

Because logic only has two states to concern itself with, rather than ten, it must deal with numbers either as base two... which is rather useless if you have more than two of something... or as some base which is an even power of two. The commonly used one is base sixteen, hexadecimal, although a lot of early logic design used octal, or base eight. In a real sense the logic doesn't care, and much of the numerical head bashing which goes on about logic design is for the convenience of logic designers.

Allowing that we have a series of logical states, like this:

```
0000
```

The rightmost state will represent the number of ones in the number, the next to rightmost state will be the number of twos, followed by the fours and the eights. These values are two raised to the power of zero, one, two and three respectively.

We can use this arrangement to represent actual numerical data... in this case, numbers from zero through fifteen. The numbers work out like this.

```
0000  0
0001  1
0010  2
0011  3
0100  4
0101  5
0110  6
0111  7
1000  8
1001  9
1010  10
1011  11
1100  12
1101  13
1110  14
1111  15
```

There's all sorts of significance to this table, some of which won't be apparent for a while. However, note that each of the state diagrams... binary numbers in computer terms... can be derived from the previous one by doing a binary addition of one to the previous value. Let's see how this works in state terms.

The binary value for eleven is

```
1011
```

If we were to add one to this, we would do the following in state terms.

```
1011
 +0001
```

Now, let's work through this, starting with the rightmost value. One plus one is two... in most parts of the universe... but

two is an illegal value for a system which can only represent zeros and ones. As such, the result of this calculation is zero with carry. The next state would be oneplus zero plus the one represented by the carry. This would be zero, and again there would be a carry. The next state would be zero plus zero plus the one of the carry, for a grand total of one. The final, or "high order" state would be one plus zero with no carry. The resulting binary number would be

1100

which is, in fact, twelve.

Obviously, this is something which could be handled using gates. A binary adder is a simple logic array which accepts two binary numbers and produces a binary result. We'll discuss the design of such an array shortly.

There's another way of looking at the process of binary counting, one which is important in discussing counting circuits, a primary tenet of logic design. Consider that each state can be derived from the last by flipping individual logic lines, or bits. Beginning with zero, flipping the low order, or rightmost, state gives you one. Flip it again and it returns to zero and its carry flips the next state, giving you two. Flip it again and it becomes one, giving you three. Flip it again and it becomes zero, Its carry flips the next state, which also becomes zero. Its carry, it turn, flips the next state, giving you four.

Postulating a black box which behaves in this way, four such boxes would allow you to count in increments of one from zero through fifteen. Such boxes are, of course, the basic logic elements called flip-flops, of which much more will be said later.

Hard Design

Figure one illustrates a complete schematic for a four bit binary adder, this one pinched from a logic manual. If you study this thing for a moment you'll understand what it's up to... and that it's not a fierce as it appears.

If you look at any one of the four groups of gates at the left of the diagram, you'll pretty well see how a single bit of binary addition works. The NOR gates handle the addition and NAND gates handle the carry. If both inputs are one, the result of the addition must be to set the carry for this binary digit, passing the carry on to the next one. Otherwise, the result of the two input bits will be found by ORing them. If either is one, the result will be one.

The binary adder represents a typical example of logic design. We can analyse it here with the leisure of hindsight, but the approach to creating it will apply to any logic array which accepts a finite number of binary states as input and produces a finite number of states as output.

In order to create a binary adder from scratch, you would start with the problem of adding two single binary states together. We can represent them and the result of the as yet undesigned adder with truth tables.

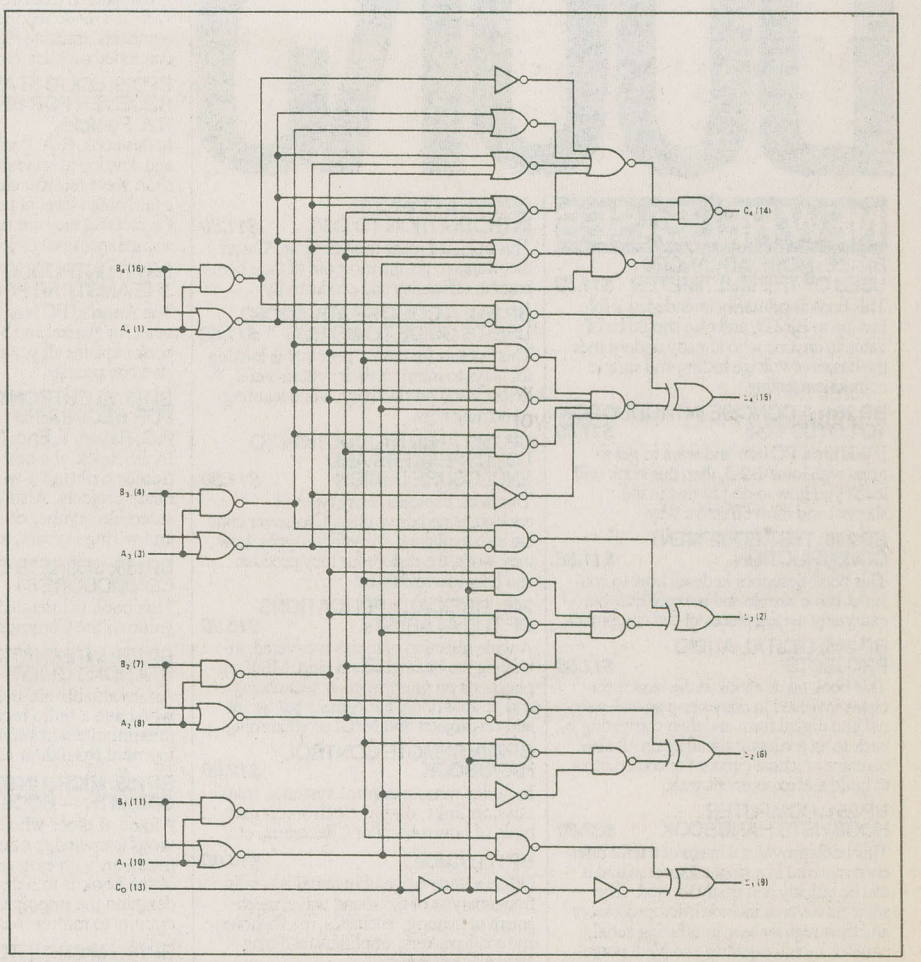
STATE 1	STATE 2	OUTPUT	CARRY
0	0	0	0
1	0	1	0
0	1	1	0
1	1	0	0

It would be easy enough to design a logic array which would accept these two sets of input states and produce these two output states. In a sense, you don't have to know how to do binary addition... all you have to do is to create a gate array which produces the desired truth table.

The approach to designing the four bit binary adder in Figure one is essentially the same, and the design problem would typically involve a fairly massive truth table. Once again, the project is not really to design a circuit which adds *per se*, but rather one which produces the desired truth table.

Many complex logic circuits can be dealt with this way. This approach tends to fall apart when you get into dynamic logic circuits, those for which you cannot develop a state diagram or truth table. A counter is a good example of this. Its output states are based both on its current input states and on the its previous input states.

We'll get into the rational for designing dynamic logic arrays later in this series. ■



The logical functions of the 74C83 4-bit binary full adder.

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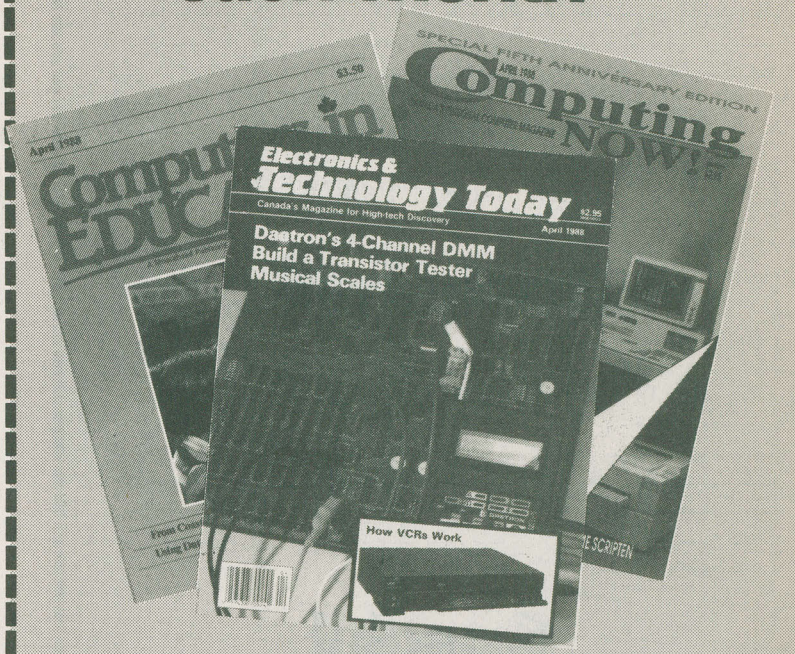

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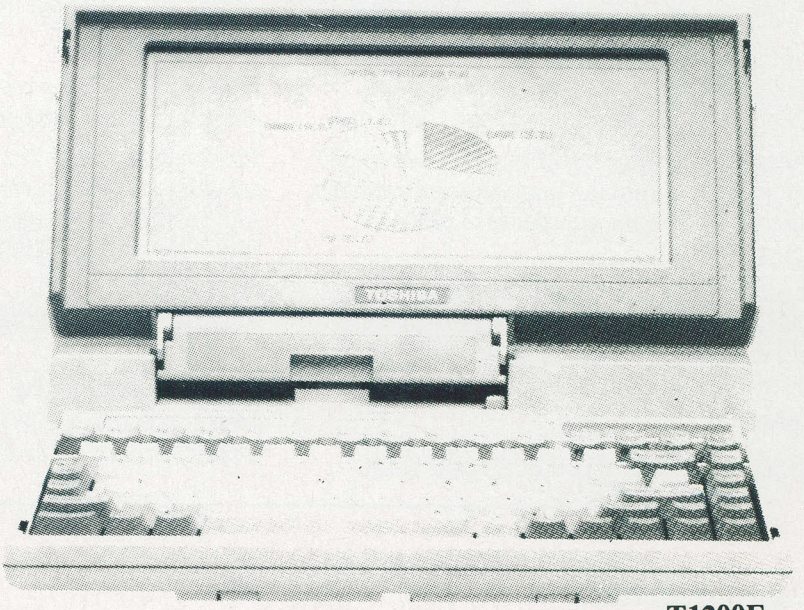

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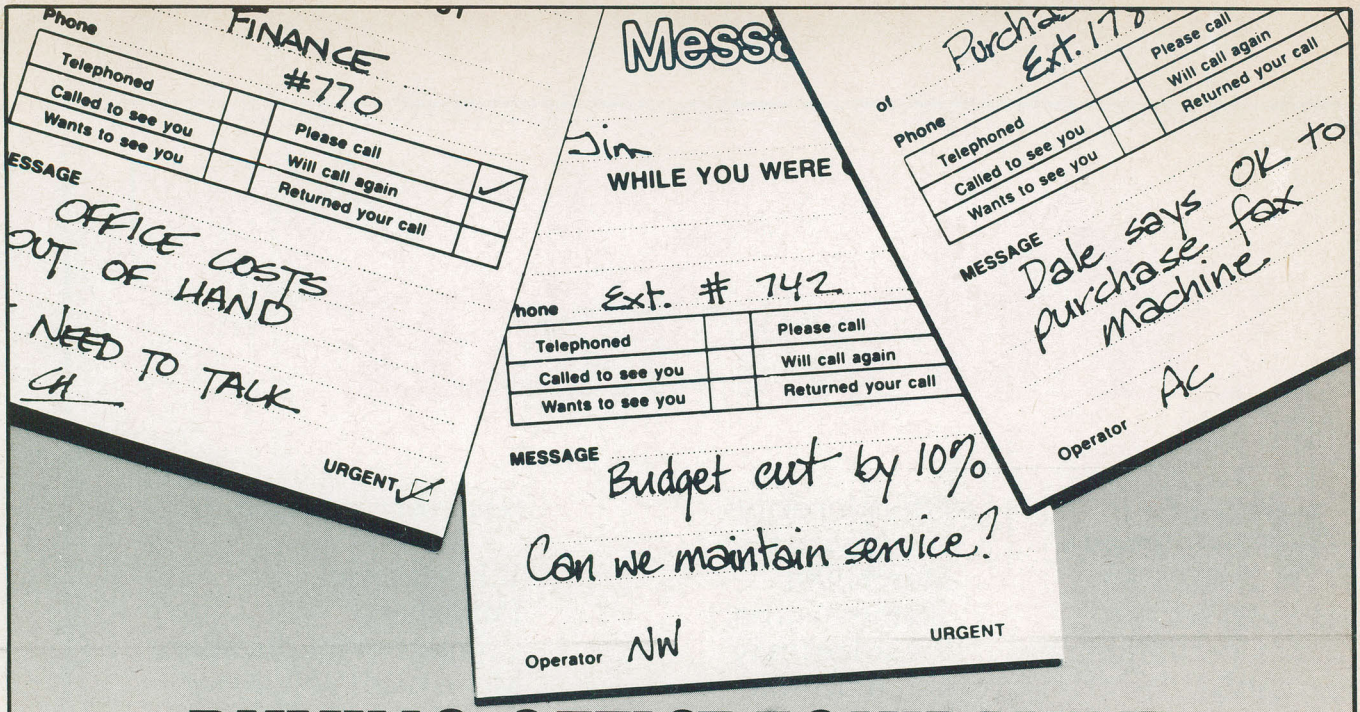

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